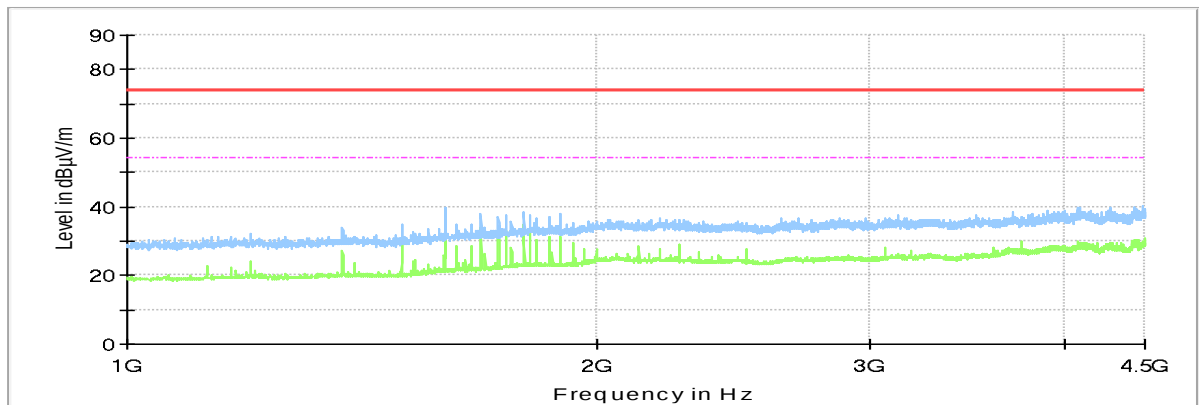




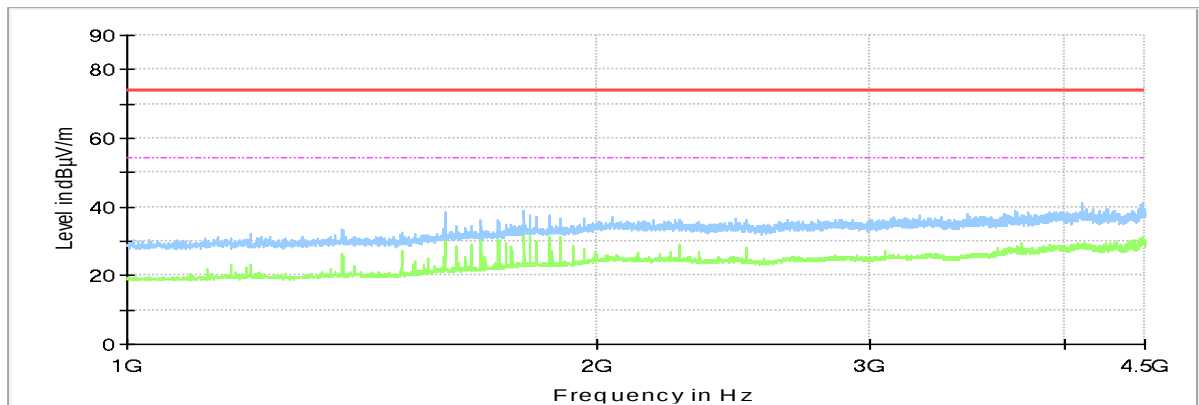
Test specification:		FCC section 15.407(b)1, RSS-247 section 6.2.4, Field strength of undesirable emissions	
Test procedure:		KDB 662911; KDB 789033, ANSI C63.10, section 12.7.6 & 12.7.7	
Test mode:		Verdict: PASS	
Date(s):			
07-Feb-19			
Temperature: 25 °C	Relative Humidity: 46 %	Air Pressure: 1012 hPa	Power: 48 VDC
Remarks:			

Plot 7.13.10 Radiated emission measurements from 1.0 to 4.5 GHz at the low carrier frequency

TEST SITE: Semi Anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical and Horizontal

**Plot 7.13.11 Radiated emission measurements from 1.0 to 4.5 GHz at the mid carrier frequency**

TEST SITE: Anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical and Horizontal

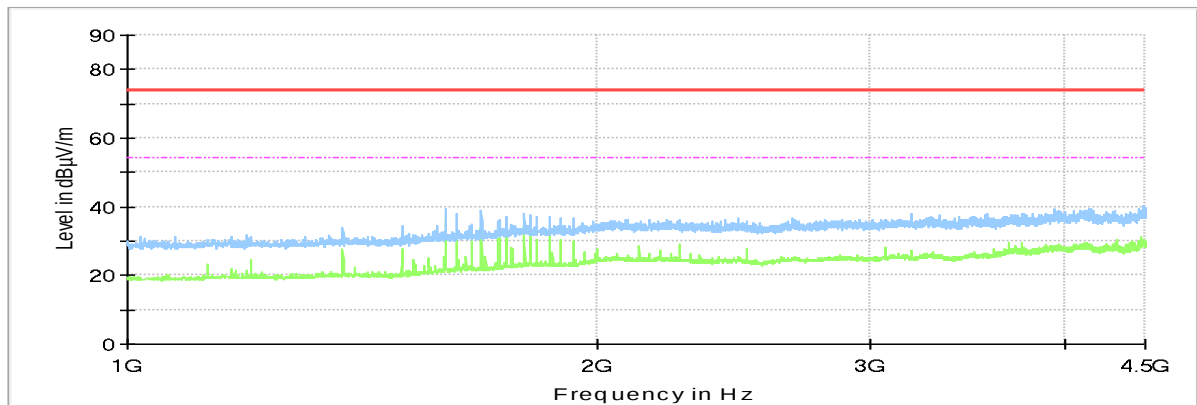




Test specification:		FCC section 15.407(b)1, RSS-247 section 6.2.4, Field strength of undesirable emissions	
Test procedure:		KDB 662911; KDB 789033, ANSI C63.10, section 12.7.6 & 12.7.7	
Test mode:		Verdict: PASS	
Date(s):			
07-Feb-19			
Temperature: 25 °C	Relative Humidity: 46 %	Air Pressure: 1012 hPa	Power: 48 VDC
Remarks:			

Plot 7.13.12 Radiated emission measurements from 1.0 to 4.5 GHz at the high carrier frequency

TEST SITE: Anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical and Horizontal





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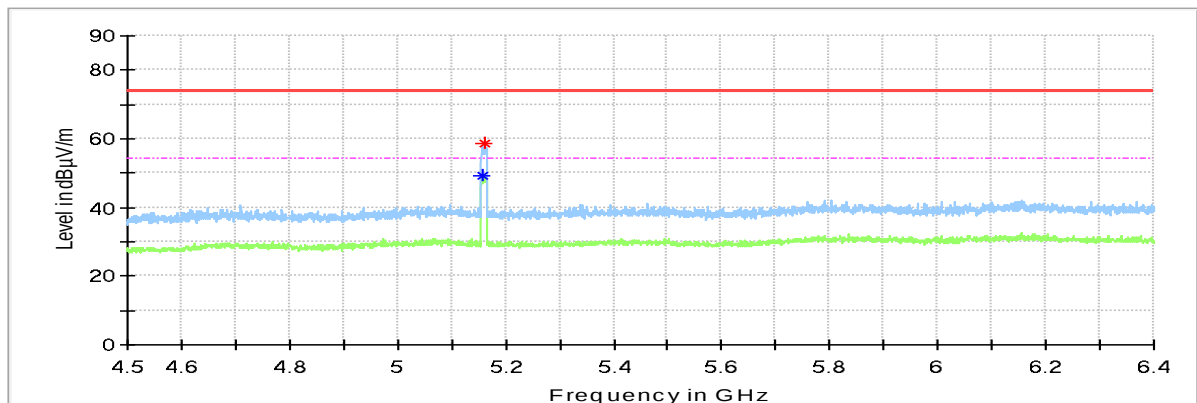
Report ID: TELRAD_FCC.31830

Date of Issue: 28-May-19

Test specification:		FCC section 15.407(b)1, RSS-247 section 6.2.4, Field strength of undesirable emissions	
Test procedure:		KDB 662911; KDB 789033, ANSI C63.10, section 12.7.6 & 12.7.7	
Test mode:		Verdict: PASS	
Date(s):			
07-Feb-19			
Temperature: 25 °C	Relative Humidity: 46 %	Air Pressure: 1012 hPa	Power: 48 VDC
Remarks:			

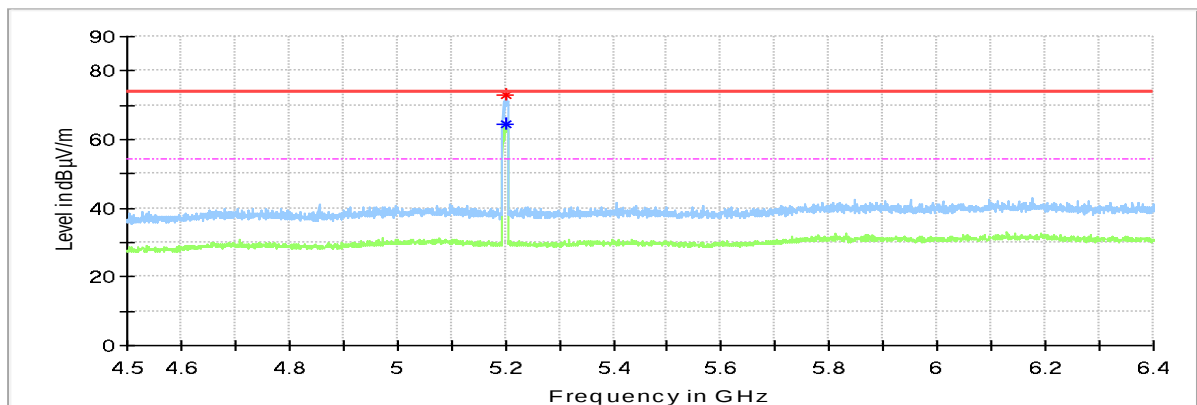
Plot 7.13.13 Radiated emission measurements from 4.5 to 6.4 GHz at the low carrier frequency with TX output ports terminated

TEST SITE: Semi Anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical and Horizontal



Plot 7.13.14 Radiated emission measurements from 4.5 to 6.4 GHz at the mid carrier frequency with TX output ports terminated

TEST SITE: Anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical and Horizontal





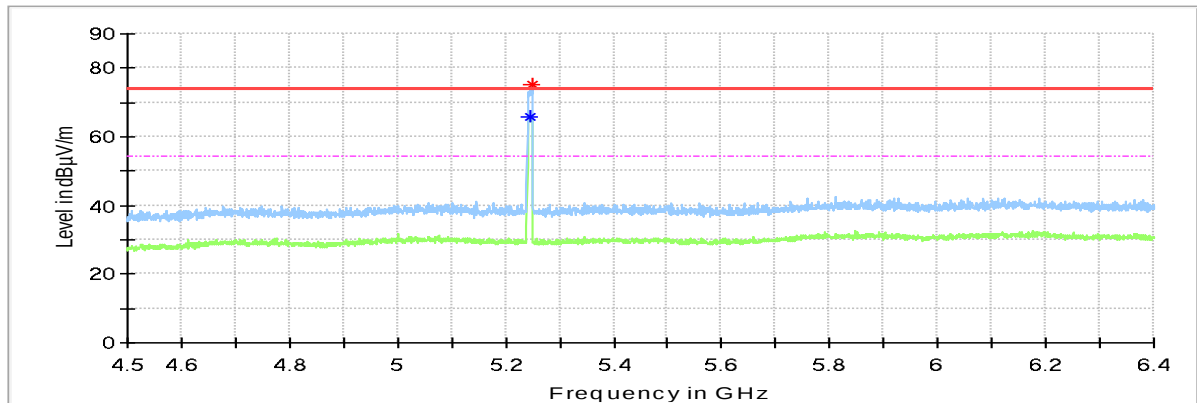
HERMON LABORATORIES

Report ID: TELRAD_FCC.31830
Date of Issue: 28-May-19

Test specification:		FCC section 15.407(b)1, RSS-247 section 6.2.4, Field strength of undesirable emissions	
Test procedure:		KDB 662911; KDB 789033, ANSI C63.10, section 12.7.6 & 12.7.7	
Test mode:		Verdict: PASS	
Date(s):			
07-Feb-19			
Temperature: 25 °C	Relative Humidity: 46 %	Air Pressure: 1012 hPa	Power: 48 VDC
Remarks:			

Plot 7.13.15 Radiated emission measurements from 4.5 to 6.4 GHz at the high carrier frequency with TX output ports terminated

TEST SITE: Anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical and Horizontal

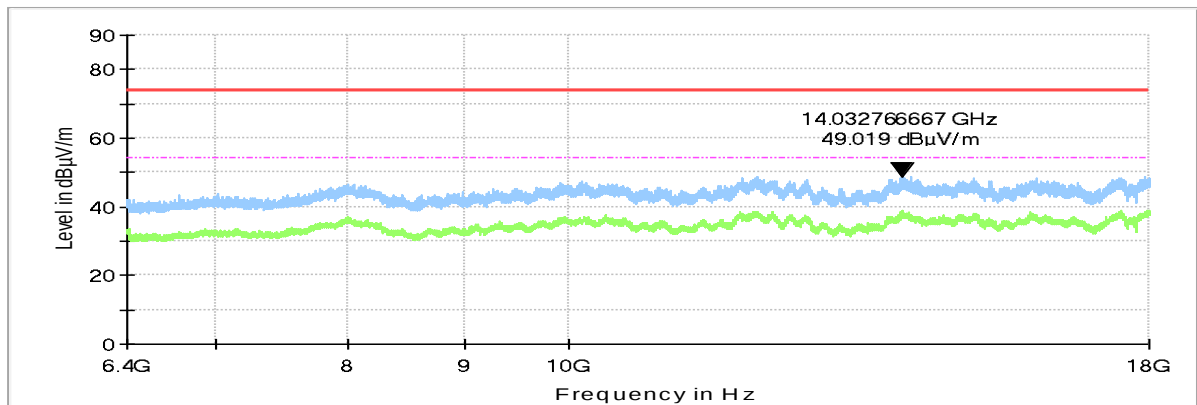




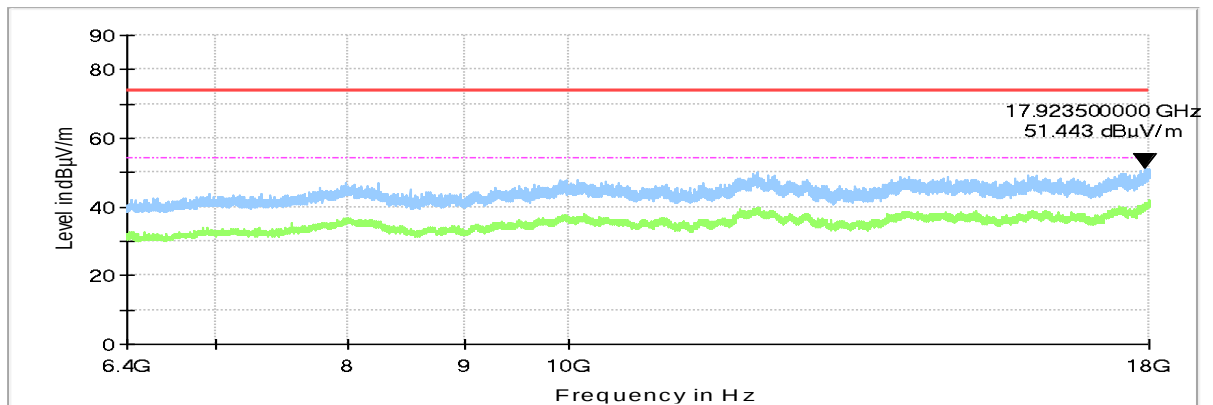
Test specification:		FCC section 15.407(b)1, RSS-247 section 6.2.4, Field strength of undesirable emissions	
Test procedure:		KDB 662911; KDB 789033, ANSI C63.10, section 12.7.6 & 12.7.7	
Test mode:		Verdict: PASS	
Date(s):			
07-Feb-19			
Temperature: 25 °C	Relative Humidity: 46 %	Air Pressure: 1012 hPa	Power: 48 VDC
Remarks:			

Plot 7.13.16 Radiated emission measurements from 6.4 to 18 GHz at the low carrier frequency

TEST SITE: Semi Anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical and Horizontal

**Plot 7.13.17 Radiated emission measurements from 6.4 to 18 GHz at the mid carrier frequency**

TEST SITE: Anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical and Horizontal





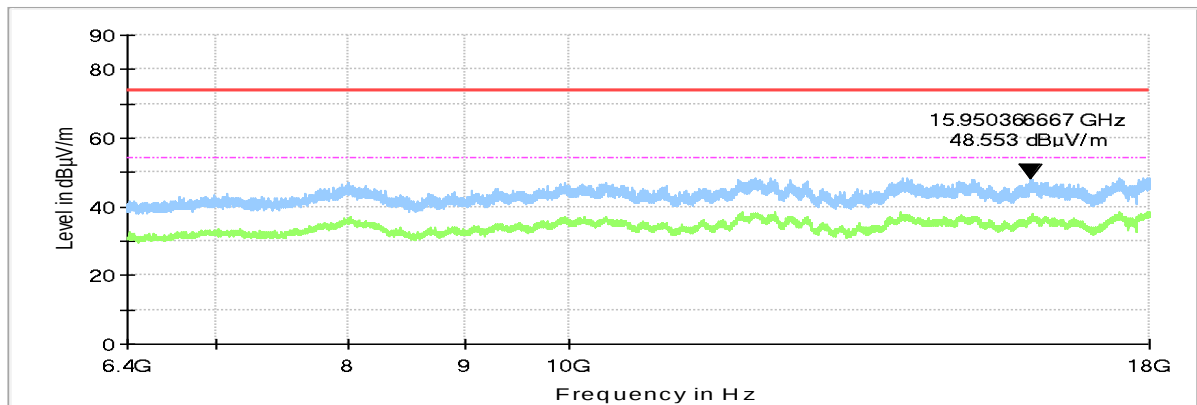
HERMON LABORATORIES

Report ID: TELRAD_FCC.31830
Date of Issue: 28-May-19

Test specification:		FCC section 15.407(b)1, RSS-247 section 6.2.4, Field strength of undesirable emissions	
Test procedure:		KDB 662911; KDB 789033, ANSI C63.10, section 12.7.6 & 12.7.7	
Test mode:		Verdict: PASS	
Date(s):			
07-Feb-19			
Temperature: 25 °C	Relative Humidity: 46 %	Air Pressure: 1012 hPa	Power: 48 VDC
Remarks:			

Plot 7.13.18 Radiated emission measurements from 6.4 to 18 GHz at the high carrier frequency

TEST SITE: Anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical and Horizontal

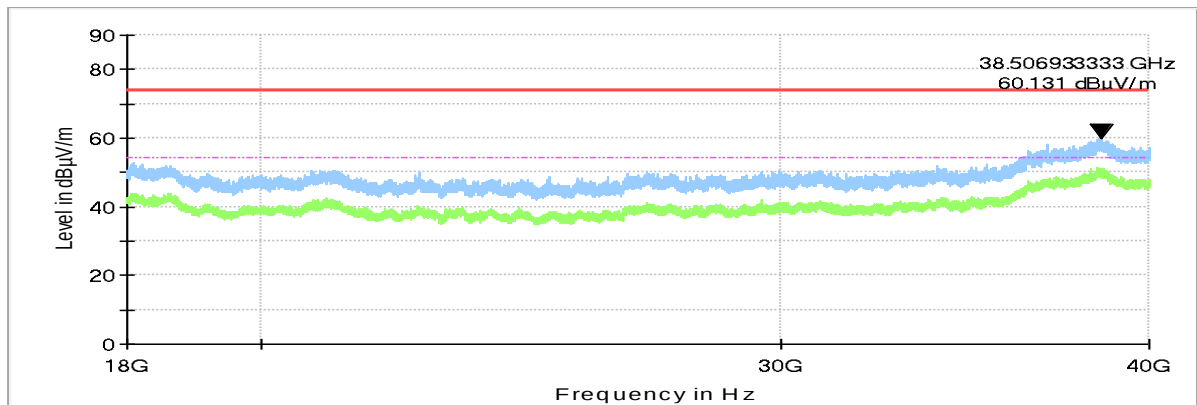




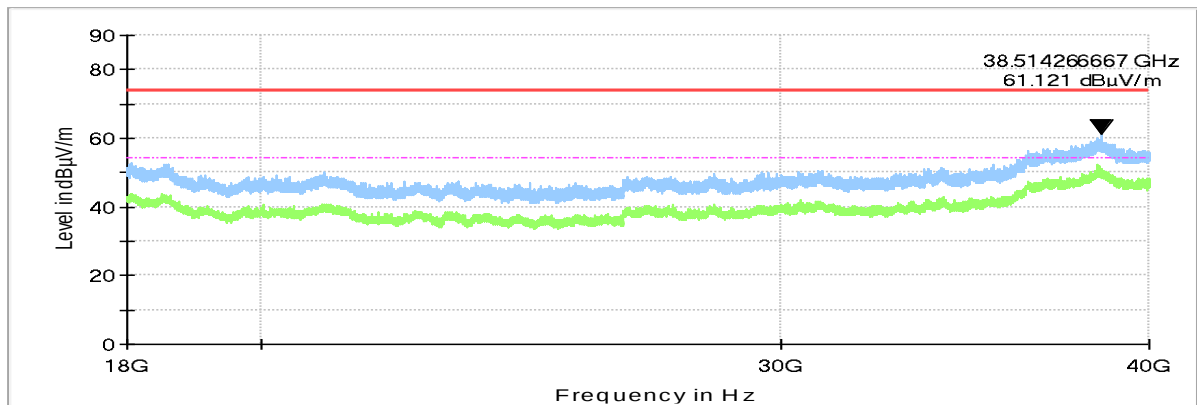
Test specification:		FCC section 15.407(b)1, RSS-247 section 6.2.4, Field strength of undesirable emissions	
Test procedure:		KDB 662911; KDB 789033, ANSI C63.10, section 12.7.6 & 12.7.7	
Test mode:		Verdict: PASS	
Date(s):			
07-Feb-19			
Temperature: 25 °C	Relative Humidity: 46 %	Air Pressure: 1012 hPa	Power: 48 VDC
Remarks:			

Plot 7.13.19 Radiated emission measurements from 18 to 40 GHz at the low carrier frequency

TEST SITE: Semi Anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical and Horizontal

**Plot 7.13.20 Radiated emission measurements from 18 to 40 GHz at the mid carrier frequency**

TEST SITE: Anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical and Horizontal





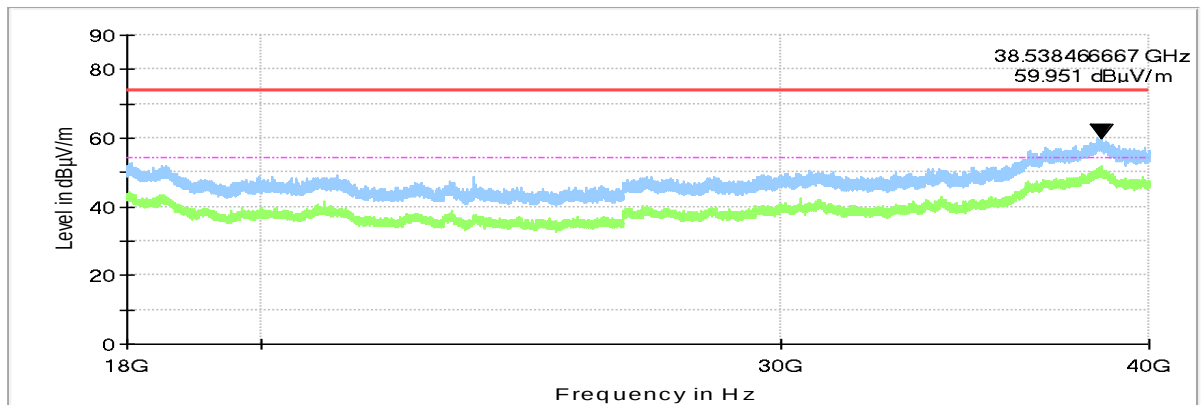
HERMON LABORATORIES

Report ID: TELRAD_FCC.31830
Date of Issue: 28-May-19

Test specification:		FCC section 15.407(b)1, RSS-247 section 6.2.4, Field strength of undesirable emissions	
Test procedure:		KDB 662911; KDB 789033, ANSI C63.10, section 12.7.6 & 12.7.7	
Test mode:		Verdict: PASS	
Date(s):			
07-Feb-19			
Temperature: 25 °C	Relative Humidity: 46 %	Air Pressure: 1012 hPa	Power: 48 VDC
Remarks:			

Plot 7.13.21 Radiated emission measurements from 18 to 40 GHz at the high carrier frequency

TEST SITE: Anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical and Horizontal





Test specification:		FCC section 15.407(b)4, RSS-247 section 6.2.4, Field strength of undesirable emissions	
Test procedure:		KDB 662911; KDB 789033, ANSI C63.10, section 12.7.6 & 12.7.7	
Test mode:		Verdict: PASS	
Date(s):			
07-Feb-19			
Temperature: 25 °C	Relative Humidity: 46 %	Air Pressure: 1012 hPa	Power: 48 VDC
Remarks:			

7.14 Field strength of undesirable emissions at 5725 – 5850 MHz range

7.14.1 General

This test was performed to measure field strength of spurious emissions from the EUT. Specification test limits are given in Table 7.14.1, Table 7.14.2.

Table 7.14.1 Unwanted emissions limits below 1 GHz and within restricted bands above 1 GHz

Frequency, MHz	Field strength at 3 m, dB(μV/m)*		
	Peak	Quasi Peak	Average
0.009 – 0.090	148.5 – 128.5	NA	128.5 – 108.5**
0.090 – 0.110	NA	108.5 – 106.8**	NA
0.110 – 0.490	126.8 – 113.8	NA	106.8 – 93.8**
0.490 – 1.705	NA	73.8 – 63.0**	NA
1.705 – 30.0*		69.5	
30 – 88		40.0	
88 – 216		43.5	
216 – 960		46.0	
960 – 1000		54.0	
1000 – 40000	74.0	NA	54.0

*- The limit for 3 m test distance was calculated using the inverse square distance extrapolation factor as follows:

$$\text{Lim}_{S2} = \text{Lim}_{S1} + 40 \log (S_1/S_2),$$

where S_1 and S_2 – standard defined and test distance respectively in meters.

** - The limit decreases linearly with the logarithm of frequency.

Table 7.14.2 EIRP of undesirable emission limits outside restricted bands (above 1 GHz)

Operating frequency band, GHz	EIRP of spurious, dBm/MHz	Field strength at 3 m, dB(μV/m)
5.150 – 5.250	-27	68.23
5.250 – 5.350	-27	68.23
5.470 – 5.725	-27	68.23
5.725 – 5.850	-27 (below 5.650 GHz and above 5.925 GHz)	68.23
	-27 increasing linearly to 10 (in 5.650 - 5.700 GHz and 5.875 - 5.925 GHz)	68.23 - 105.23*
	10 increasing linearly to 15.6 (in 5.700 - 5.720 GHz and 5.855 - 5.875 GHz)	105.23 - 110.83*
	15.6 increasing linearly to 27 (in 5.720 - 5.725 GHz and 5.850 - 5.855 GHz)	110.83 - 122.23*

Test specification:		FCC section 15.407(b)4, RSS-247 section 6.2.4, Field strength of undesirable emissions	
Test procedure:		KDB 662911; KDB 789033, ANSI C63.10, section 12.7.6 & 12.7.7	
Test mode:		Verdict: PASS	
Date(s):			
07-Feb-19			
Temperature: 25 °C	Relative Humidity: 46 %	Air Pressure: 1012 hPa	Power: 48 VDC
Remarks:			

Test procedure for spurious emission field strength measurements in 9 kHz to 30 MHz band

7.14.1.1 The EUT was set up as shown in Figure 7.14.1, energized and the performance check was conducted.

7.14.1.2 The specified frequency range was investigated with antenna connected to spectrum analyzer/ EMI receiver. To find maximum radiation the turntable was rotated 360° and the measuring antenna was rotated around its vertical axis.

7.14.1.3 The worst test results (the lowest margins) were recorded and shown in the associated plots.

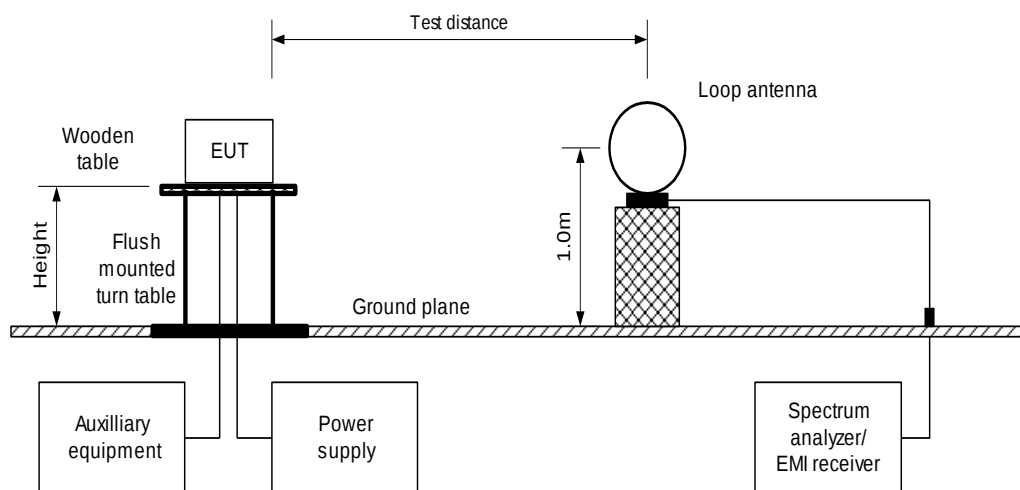
Test procedure for spurious emission field strength measurements above 30 MHz

7.14.1.4 The EUT was set up as shown in Figure 7.14.2, Figure 7.14.3, energized and the performance check was conducted.

7.14.1.5 The specified frequency range was investigated with antenna connected to spectrum analyzer/ EMI receiver. To find maximum radiation the turntable was rotated 360°, the measuring antenna height was changed from 1 to 4 m, its polarization was switched from vertical to horizontal.

7.14.1.6 The worst test results (the lowest margins) were recorded and shown in the associated plots.

Figure 7.14.1 Setup for spurious emission field strength measurements below 30 MHz



Test specification:		FCC section 15.407(b)4, RSS-247 section 6.2.4, Field strength of undesirable emissions	
Test procedure:		KDB 662911; KDB 789033, ANSI C63.10, section 12.7.6 & 12.7.7	
Test mode:		Verdict: PASS	
Date(s):			
07-Feb-19			
Temperature: 25 °C	Relative Humidity: 46 %	Air Pressure: 1012 hPa	Power: 48 VDC
Remarks:			

Figure 7.14.2 Setup for spurious emission field strength measurements from 30 to 1000 MHz

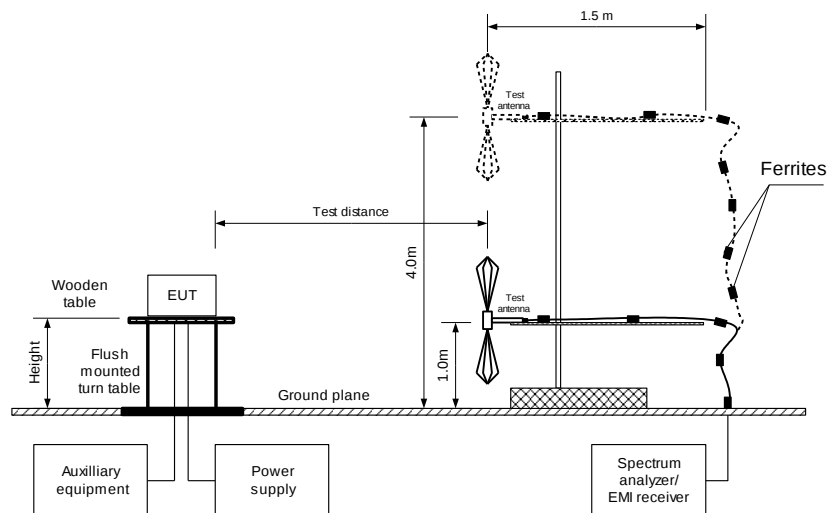
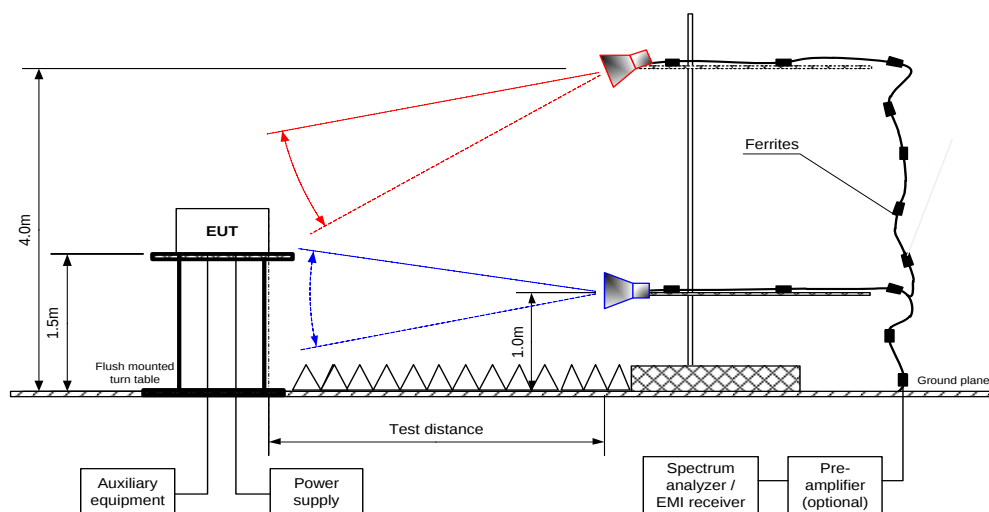


Figure 7.14.3 Setup for spurious emission field strength measurements above 1000 MHz





Test specification:		FCC section 15.407(b)4, RSS-247 section 6.2.4, Field strength of undesirable emissions	
Test procedure:		KDB 662911; KDB 789033, ANSI C63.10, section 12.7.6 & 12.7.7	
Test mode:		Verdict: PASS	
Date(s):			
07-Feb-19			
Temperature: 25 °C	Relative Humidity: 46 %	Air Pressure: 1012 hPa	Power: 48 VDC
Remarks:			

Table 7.14.3 Field strength of spurious emissions below 1 GHz

ASSIGNED FREQUENCY BAND: 5.725 – 5.850 GHz
 INVESTIGATED FREQUENCY RANGE: 0.009 – 1000 MHz
 TEST DISTANCE: 3 m
 MODULATION: QPSK
 TRANSMITTER OUTPUT POWER: Maximum
 RESOLUTION BANDWIDTH: 1 kHz (9 kHz – 150 kHz)
 9.0 kHz (150 kHz – 30 MHz)
 120 kHz (30 MHz – 1000 MHz)
 VIDEO BANDWIDTH: > Resolution bandwidth
 TEST ANTENNA TYPE: Active loop (9 kHz – 30 MHz)
 Biconilog (30 MHz – 1000 MHz)

Frequency, MHz	Peak emission, dB(µV/m)	Quasi-peak			Antenna polarization	Antenna height, m	Turn-table position**, degrees	Verdict
		Measured emission, dB(µV/m)	Limit, dB(µV/m)	Margin, dB*				
Low, mid, high carrier frequency								
38.96413	36.20	32.11	40.00	-7.89	Vertical	102.0	180.0	Pass
101.8846	34.92	32.36	43.50	-11.14	Vertical	102.0	-131.0	
245.7722	47.00	44.06	46.00	-1.94	Horizontal	132.0	138.0	
375.0029	41.27	38.75	46.00	-7.25	Vertical	132.0	-3.0	
874.9879	43.06	40.93	46.00	-5.07	Horizontal	132.0	-44.0	

*- Margin = Measured emission - specification limit.

** - EUT front panel refer to 0 degrees position of turntable.

Table 7.14.4 Field strength of emissions above 1 GHz outside restricted bands

ASSIGNED FREQUENCY BAND: 5.725 – 5.850 GHz
 INVESTIGATED FREQUENCY RANGE: 1000 – 40000 MHz
 TEST DISTANCE: 3 m
 MODULATION: QPSK
 TRANSMITTER OUTPUT POWER: Maximum
 DETECTOR: USED: Peak
 RESOLUTION BANDWIDTH: 1000 kHz
 TEST ANTENNA TYPE: Biconilog (30 MHz – 1000 MHz)
 Double ridged guide (above 1000 MHz)

Frequency, MHz	Antenna polarization	Antenna height, m	Azimuth, degrees*	Field strength of spurious, dB(μV/m)	Limit, dBμV/m	Margin, dB**	Verdict
Low, mid, high carrier frequency							
All emissions are more than 20 dB below the limit							Pass

*- EUT front panel refers to 0 degrees position of turntable.

** - Margin = Measured emission - specification limit.



Test specification:		FCC section 15.407(b)4, RSS-247 section 6.2.4, Field strength of undesirable emissions	
Test procedure:		KDB 662911; KDB 789033, ANSI C63.10, section 12.7.6 & 12.7.7	
Test mode:		Verdict: PASS	
Date(s):			
07-Feb-19			
Temperature: 25 °C	Relative Humidity: 46 %	Air Pressure: 1012 hPa	Power: 48 VDC
Remarks:			

Table 7.14.5 Field strength of spurious emissions above 1 GHz within restricted bands

ASSIGNED FREQUENCY: 5.725 – 5.850 GHz
 INVESTIGATED FREQUENCY RANGE: 1000 - 40000 MHz
 TEST DISTANCE: 3 m
 MODULATION: QPSK
 DUTY CYCLE: 100 %
 TRANSMITTER OUTPUT POWER: Maximum
 DETECTOR USED: Peak
 RESOLUTION BANDWIDTH: 1000 kHz
 TEST ANTENNA TYPE: Double ridged guide

TEST ANTENNA FILE:				Double angled guide							
Frequency, MHz	Antenna		Azimuth, degrees*	Peak field strength(VBW=3 MHz)			Average field strength(VBW=1 kHz)				Verdict
	Polarization	Height, m		Measured, dB(μV/m)	Limit, dB(μV/m)	Margin, dB**	Measured, dB(μV/m)	Calculated, dB(μV/m)	Limit, dB(μV/m)	Margin, dB***	
Low, mid, high carrier frequency											
All emissions are more than 20 dB below the limit											Pass

*- EUT front panel refers to 0 degrees position of turntable.

** - Margin, dB = Measured, dB(μV/m) – Limit, dB(μV/m)

*** - Margin, dB = Calculated, dB(μV/m) – Limit, dB(μV/m)

Reference numbers of test equipment used

HL 0446	HL 0604	HL 3903	HL 4355	HL 4360	HL 4933	HL 4956	HL 5405
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Full description is given in Appendix A.

Table 7.14.6 Restricted bands according to FCC section 15.205

MHz	MHz	MHz	MHz	MHz	GHz
0.09 - 0.11	8.37625 - 8.38675	73 - 74.6	399.9 - 410	2690 - 2900	10.6 - 12.7
0.495 - 0.505	8.41425 - 8.41475	74.8 - 75.2	608 - 614	3260 - 3267	13.25 - 13.4
2.1735 - 2.1905	12.29 - 12.293	108 - 121.94	960 - 1240	3332 - 3339	14.47 - 14.5
4.125 - 4.128	12.51975 - 12.52025	123 - 138	1300 - 1427	3345.8 - 3358	15.35 - 16.2
4.17725 - 4.17775	12.57675 - 12.57725	149.9 - 150.05	1435 - 1626.5	3600 - 4400	17.7 - 21.4
4.20725 - 4.20775	13.36 - 13.41	156.52475 - 156.52525	1645.5 - 1646.5	4500 - 5150	22.01 - 23.12
6.215 - 6.218	16.42 - 16.423	156.7 - 156.9	1660 - 1710	5350 - 5460	23.6 - 24
6.26775 - 6.26825	16.69475 - 16.69525	162.0125 - 167.17	1718.8 - 1722.2	7250 - 7750	31.2 - 31.8
6.31175 - 6.31225	16.80425 - 16.80475	167.72 - 173.2	2200 - 2300	8025 - 8500	36.43 - 36.5
8.291 - 8.294	25.5 - 25.67	240 - 285	2310 - 2390	9000 - 9200	Above 38.6
8.362 - 8.366	37.5 - 38.25	322 - 335.4	2483.5 - 2500	9300 - 9500	

Table 7.14.7 Restricted bands according to RSS-Gen

MHz	MHz	MHz	MHz	MHz	GHz
0.09 - 0.11	8.291 - 8.294	16.80425 - 16.80475	399.9 - 410	3260 - 3267	10.6 - 12.7
2.1735 - 2.1905	8.362 - 8.366	25.5 - 25.67	608 - 614	3332 - 3339	13.25 - 13.4
3.020 - 3.026	8.37625 - 8.38675	37.5 - 38.25	960 - 1427	3345.8 - 3358	14.47 - 14.5
4.125 - 4.128	8.41425 - 8.41475	73 - 74.6	1435 - 1626.5	3500 - 4400	15.35 - 16.2
4.17725 - 4.17775	12.29 - 12.293	74.8 - 75.2	1645.5 - 1646.5	4500 - 5150	17.7 - 21.4
4.20725 - 4.20775	12.51975 - 12.52025	108 - 138	1660 - 1710	5350 - 5460	22.01 - 23.12
5.677 - 5.683	12.57675 - 12.57725	156.52475 - 156.52525	1718.8 - 1722.2	7250 - 7750	23.6 - 24
6.215 - 6.218	13.36 - 13.41	156.7 - 156.9	2200 - 2300	8025 - 8500	31.2 - 31.8
6.26775 - 6.26825	16.42 - 16.423	240 - 285	2310 - 2390	9000 - 9200	36.43 - 36.5
6.31175 - 6.31225	16.69475 - 16.69525	322 - 335.4	2655 - 2900	9300 - 9500	Above 38.6



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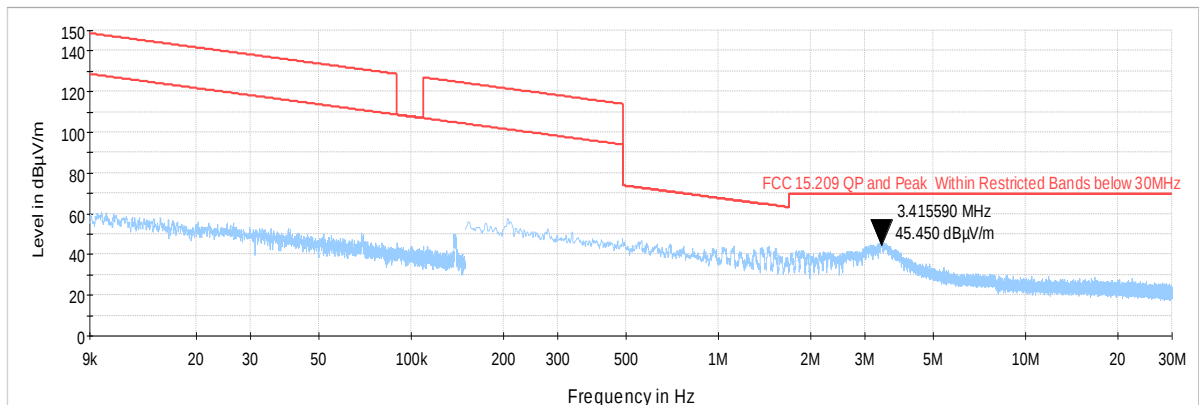
Report ID: TELRAD_FCC.31830

Date of Issue: 28-May-19

Test specification:		FCC section 15.407(b)4, RSS-247 section 6.2.4, Field strength of undesirable emissions	
Test procedure:		KDB 662911; KDB 789033, ANSI C63.10, section 12.7.6 & 12.7.7	
Test mode:		Verdict: PASS	
Date(s):			
07-Feb-19			
Temperature: 25 °C	Relative Humidity: 46 %	Air Pressure: 1012 hPa	Power: 48 VDC
Remarks:			

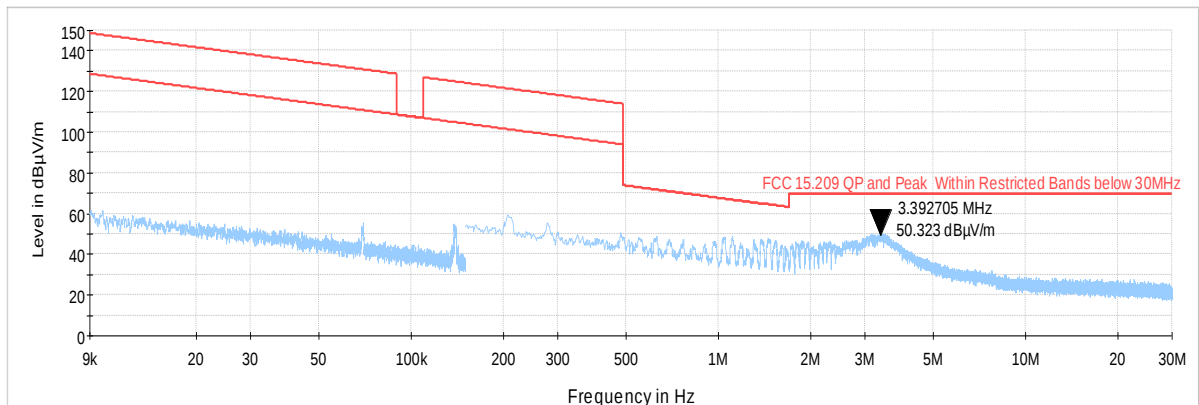
Plot 7.14.1 Radiated emission measurements from 9 kHz to 30 MHz at the low carrier frequency

TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Front 0 degree



Plot 7.14.2 Radiated emission measurements from 9 kHz to 30 MHz at the low carrier frequency

TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Side 90 degree





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Report ID: TELRAD_FCC.31830

Date of Issue: 28-May-19

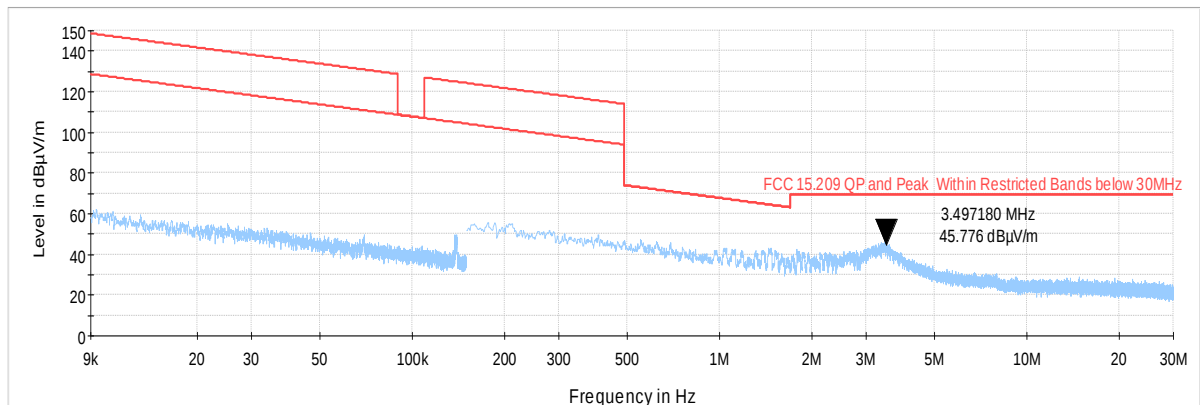
Test specification:		FCC section 15.407(b)4, RSS-247 section 6.2.4, Field strength of undesirable emissions	
Test procedure:		KDB 662911; KDB 789033, ANSI C63.10, section 12.7.6 & 12.7.7	
Test mode:		Verdict: PASS	
Date(s):			
07-Feb-19			
Temperature: 25 °C	Relative Humidity: 46 %	Air Pressure: 1012 hPa	Power: 48 VDC
Remarks:			

Plot 7.14.3 Radiated emission measurements from 9 kHz to 30 MHz at the mid carrier frequency

TEST SITE: Semi anechoic chamber

TEST DISTANCE: 3 m

ANTENNA POLARIZATION: Side 0 degree

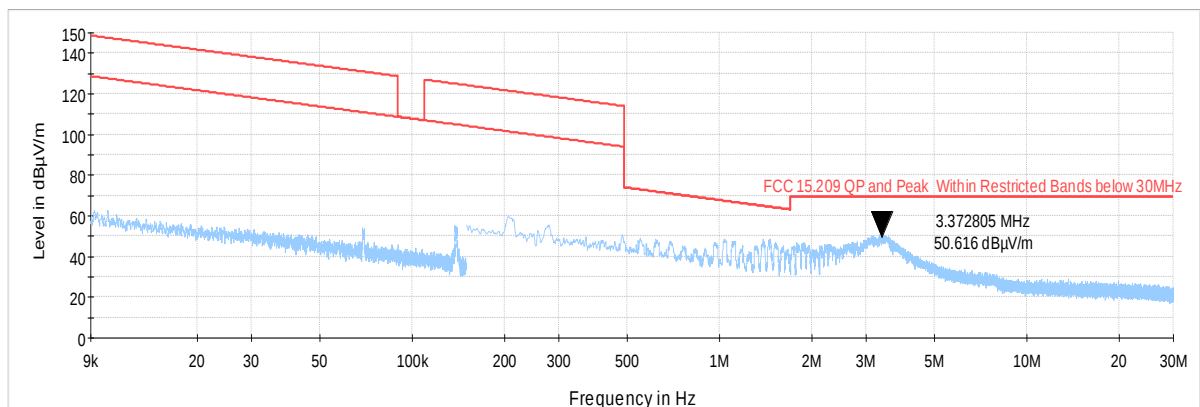


Plot 7.14.4 Radiated emission measurements from 9 kHz to 30 MHz at the mid carrier frequency

TEST SITE: Semi anechoic chamber

TEST DISTANCE: 3 m

ANTENNA POLARIZATION: Side 90 degree





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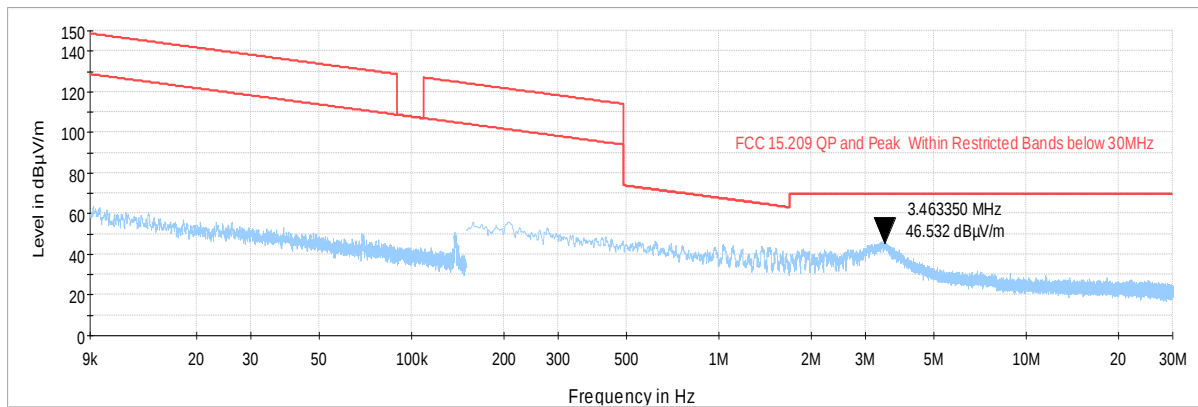
Report ID: TELRAD_FCC.31830

Date of Issue: 28-May-19

Test specification:		FCC section 15.407(b)4, RSS-247 section 6.2.4, Field strength of undesirable emissions	
Test procedure:		KDB 662911; KDB 789033, ANSI C63.10, section 12.7.6 & 12.7.7	
Test mode:		Verdict: PASS	
Date(s):			
07-Feb-19			
Temperature: 25 °C	Relative Humidity: 46 %	Air Pressure: 1012 hPa	Power: 48 VDC
Remarks:			

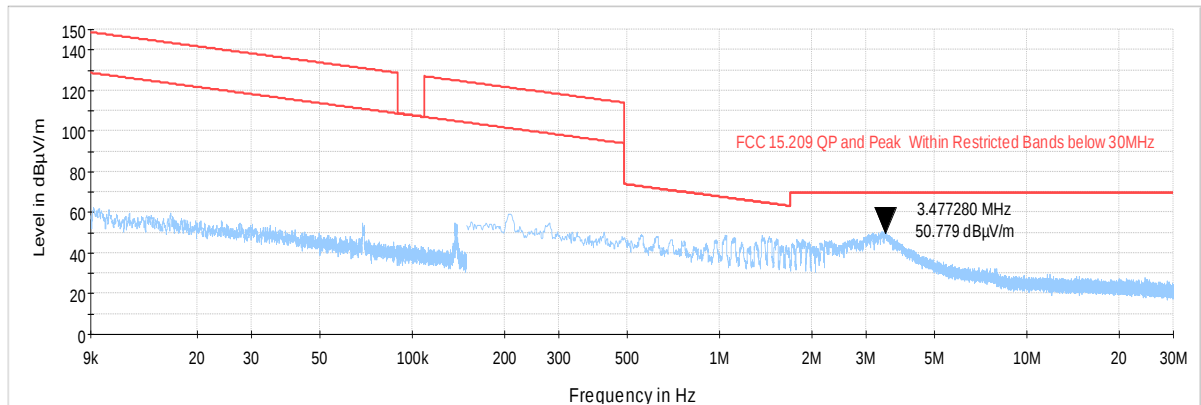
Plot 7.14.5 Radiated emission measurements from 9 kHz to 30 MHz at the high carrier frequency

TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Front 0 degree



Plot 7.14.6 Radiated emission measurements from 9 kHz to 30 MHz at the high carrier frequency

TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Side 90 degree

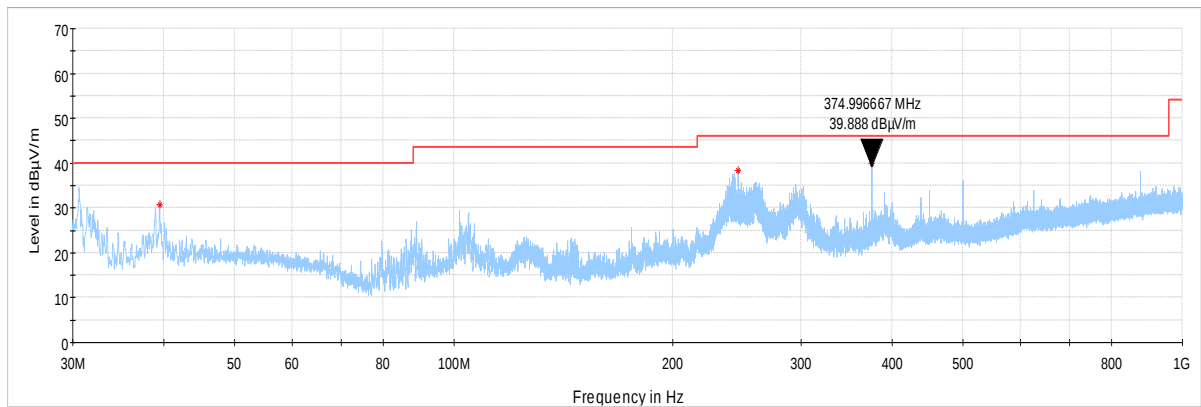




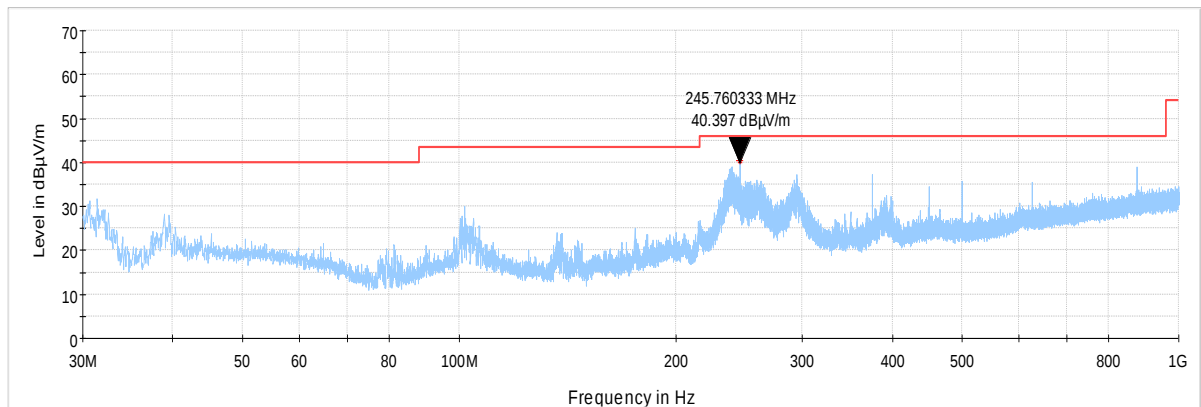
Test specification:		FCC section 15.407(b)4, RSS-247 section 6.2.4, Field strength of undesirable emissions	
Test procedure:		KDB 662911; KDB 789033, ANSI C63.10, section 12.7.6 & 12.7.7	
Test mode:		Verdict: PASS	
Date(s):			
07-Feb-19			
Temperature: 25 °C	Relative Humidity: 46 %	Air Pressure: 1012 hPa	Power: 48 VDC
Remarks:			

Plot 7.14.7 Radiated emission measurements from 30 MHz to 1000 MHz at the low carrier frequency

TEST SITE: Semi Anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical and Horizontal

**Plot 7.14.8 Radiated emission measurements from 30 MHz to 1000 MHz at the mid carrier frequency**

TEST SITE: Semi Anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical and Horizontal





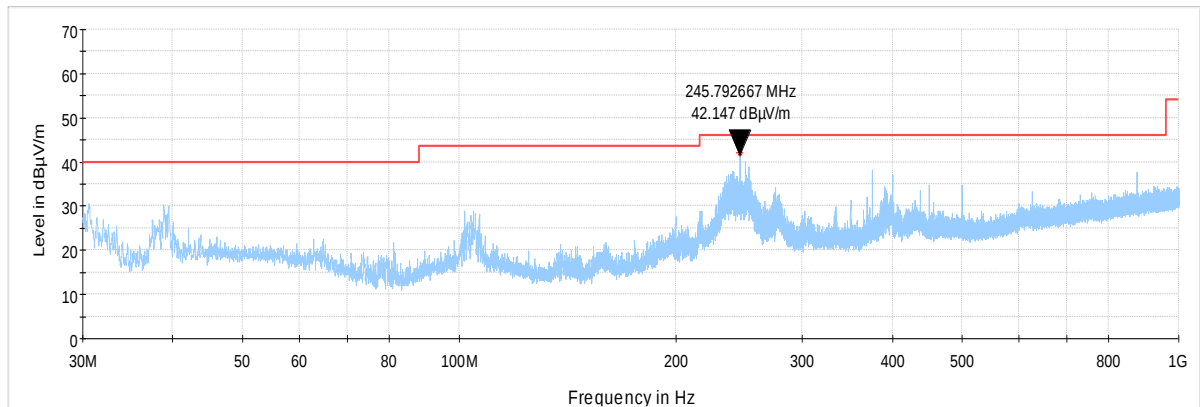
Test specification:		FCC section 15.407(b)4, RSS-247 section 6.2.4, Field strength of undesirable emissions	
Test procedure:		KDB 662911; KDB 789033, ANSI C63.10, section 12.7.6 & 12.7.7	
Test mode:		Verdict: PASS	
Date(s):			
07-Feb-19			
Temperature: 25 °C	Relative Humidity: 46 %	Air Pressure: 1012 hPa	Power: 48 VDC
Remarks:			

Plot 7.14.9 Radiated emission measurements from 30 MHz to 1000 MHz at the high carrier frequency

TEST SITE: Semi Anechoic chamber

TEST DISTANCE: 3 m

ANTENNA POLARIZATION: Vertical and Horizontal

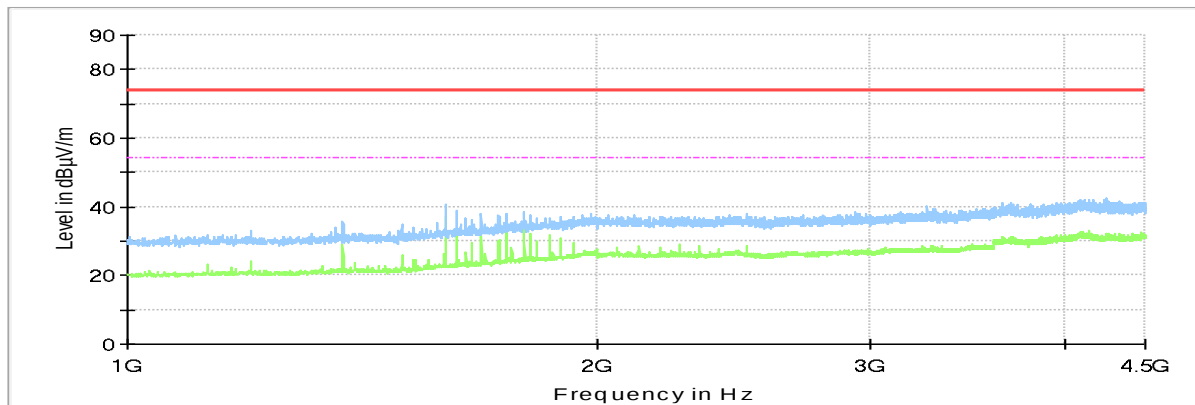




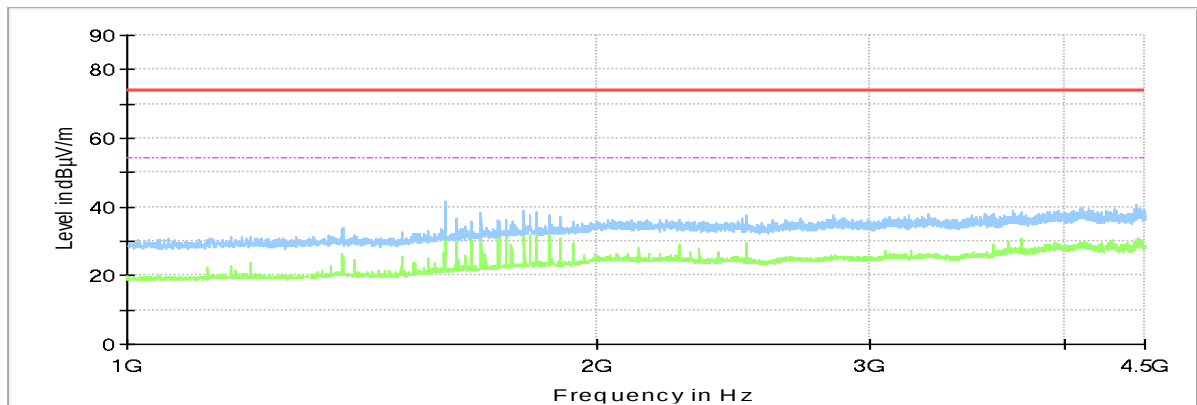
Test specification:		FCC section 15.407(b)4, RSS-247 section 6.2.4, Field strength of undesirable emissions	
Test procedure:		KDB 662911; KDB 789033, ANSI C63.10, section 12.7.6 & 12.7.7	
Test mode:		Verdict: PASS	
Date(s):			
07-Feb-19			
Temperature: 25 °C	Relative Humidity: 46 %	Air Pressure: 1012 hPa	Power: 48 VDC
Remarks:			

Plot 7.14.10 Radiated emission measurements from 1.0 to 4.5 GHz at the low carrier frequency

TEST SITE: Semi Anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical and Horizontal

**Plot 7.14.11 Radiated emission measurements from 1.0 to 4.5 GHz at the mid carrier frequency**

TEST SITE: Anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical and Horizontal

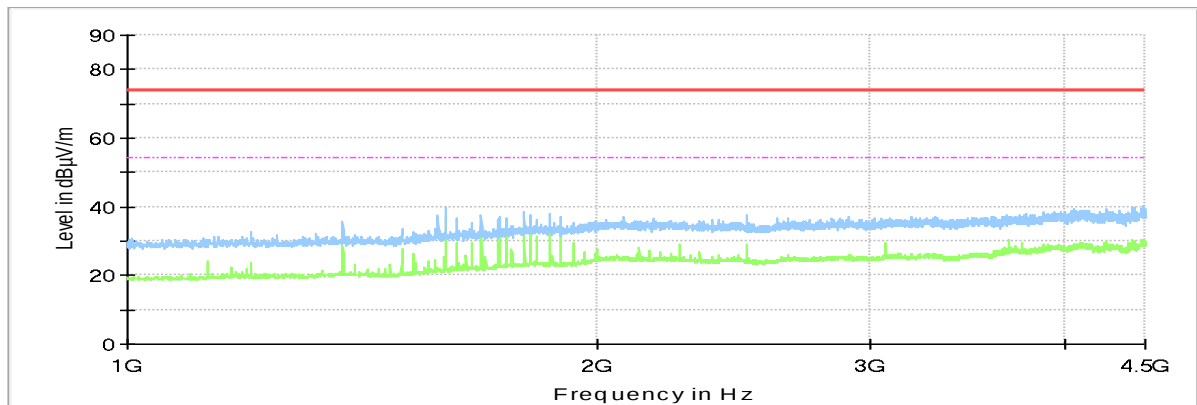




Test specification:		FCC section 15.407(b)4, RSS-247 section 6.2.4, Field strength of undesirable emissions	
Test procedure:		KDB 662911; KDB 789033, ANSI C63.10, section 12.7.6 & 12.7.7	
Test mode:		Verdict: PASS	
Date(s):			
07-Feb-19			
Temperature: 25 °C	Relative Humidity: 46 %	Air Pressure: 1012 hPa	Power: 48 VDC
Remarks:			

Plot 7.14.12 Radiated emission measurements from 1.0 to 4.5 GHz at the high carrier frequency

TEST SITE: Anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical and Horizontal





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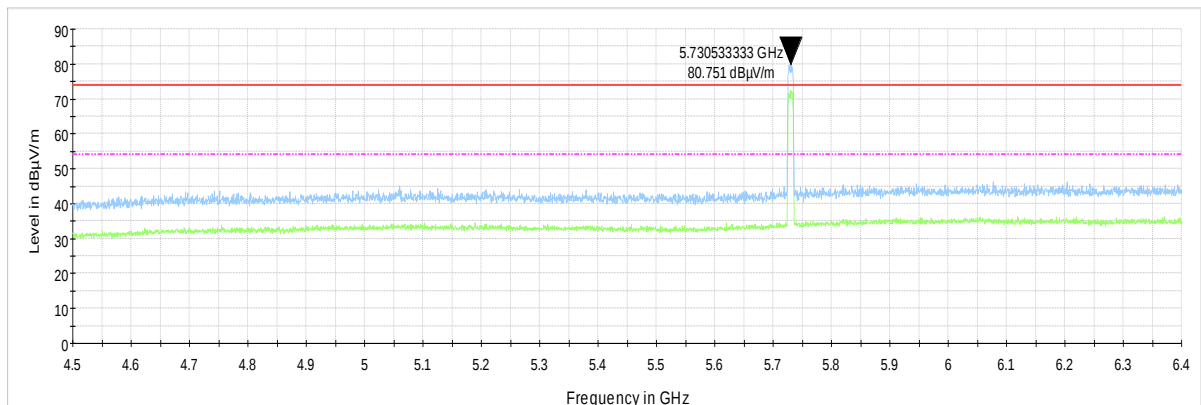
Report ID: TELRAD_FCC.31830

Date of Issue: 28-May-19

Test specification:		FCC section 15.407(b)4, RSS-247 section 6.2.4, Field strength of undesirable emissions	
Test procedure:		KDB 662911; KDB 789033, ANSI C63.10, section 12.7.6 & 12.7.7	
Test mode:		Verdict: PASS	
Date(s):			
07-Feb-19			
Temperature: 25 °C	Relative Humidity: 46 %	Air Pressure: 1012 hPa	Power: 48 VDC
Remarks:			

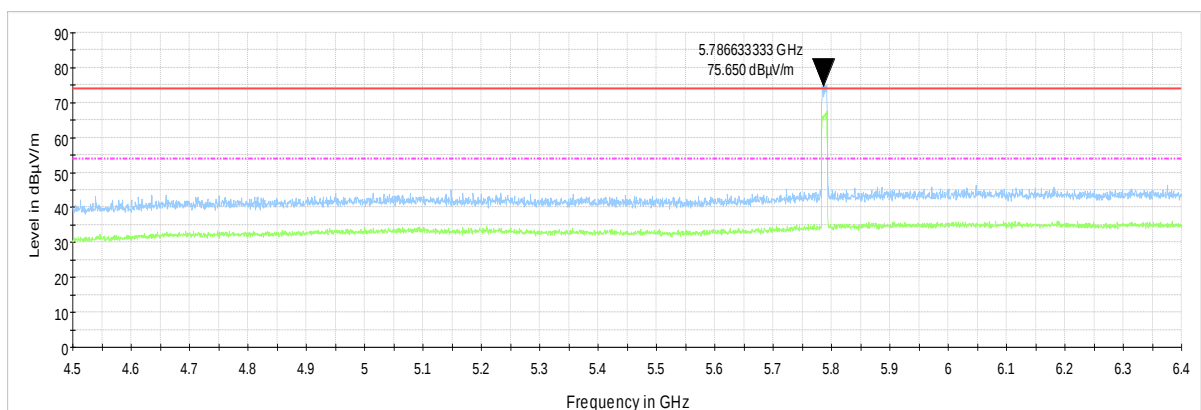
Plot 7.14.13 Radiated emission measurements from 4.5 to 6.4 GHz at the low carrier frequency with TX output ports terminated

TEST SITE: Semi Anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical and Horizontal



Plot 7.14.14 Radiated emission measurements from 4.5 to 6.4 GHz at the mid carrier frequency with TX output ports terminated

TEST SITE: Anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical and Horizontal

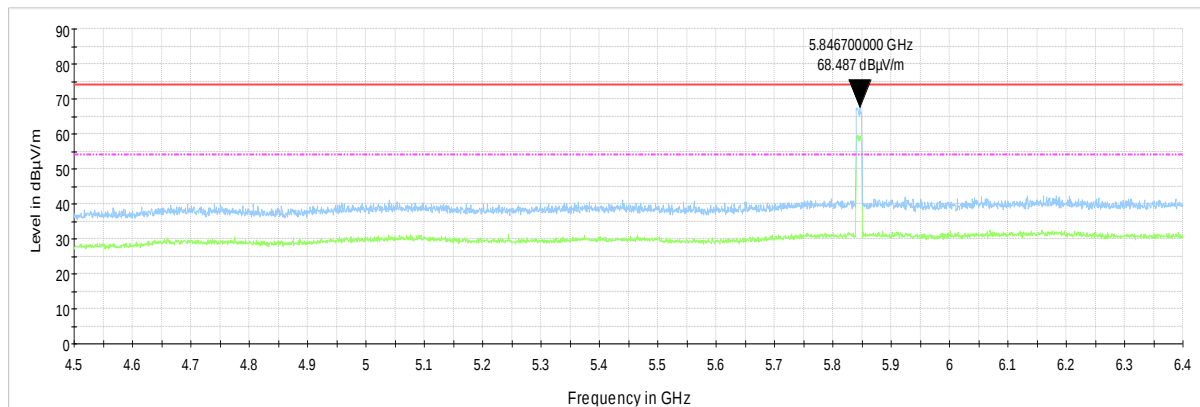




Test specification:		FCC section 15.407(b)4, RSS-247 section 6.2.4, Field strength of undesirable emissions	
Test procedure:		KDB 662911; KDB 789033, ANSI C63.10, section 12.7.6 & 12.7.7	
Test mode:		Verdict: PASS	
Date(s):			
07-Feb-19			
Temperature: 25 °C	Relative Humidity: 46 %	Air Pressure: 1012 hPa	Power: 48 VDC
Remarks:			

Plot 7.14.15 Radiated emission measurements from 4.5 to 6.4 GHz at the high carrier frequency with TX output ports terminated

TEST SITE: Anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical and Horizontal

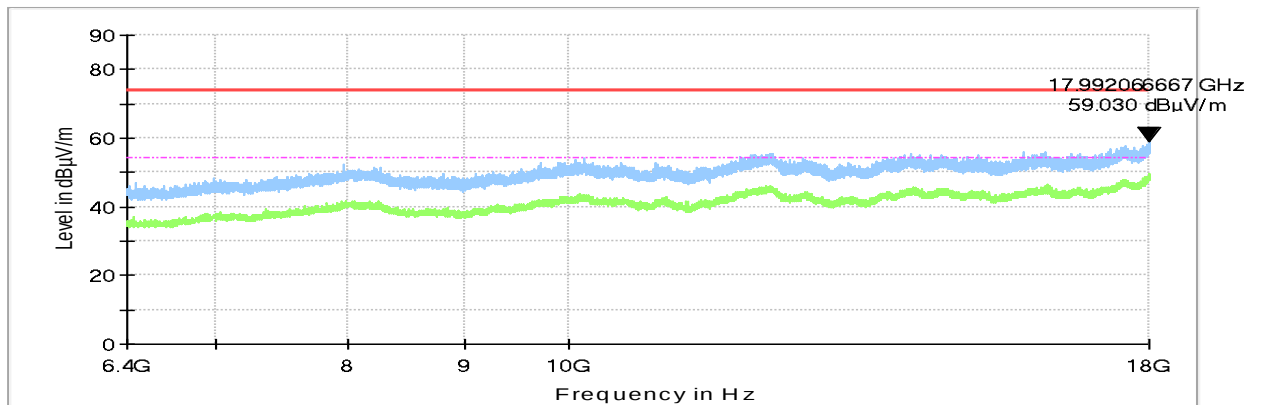




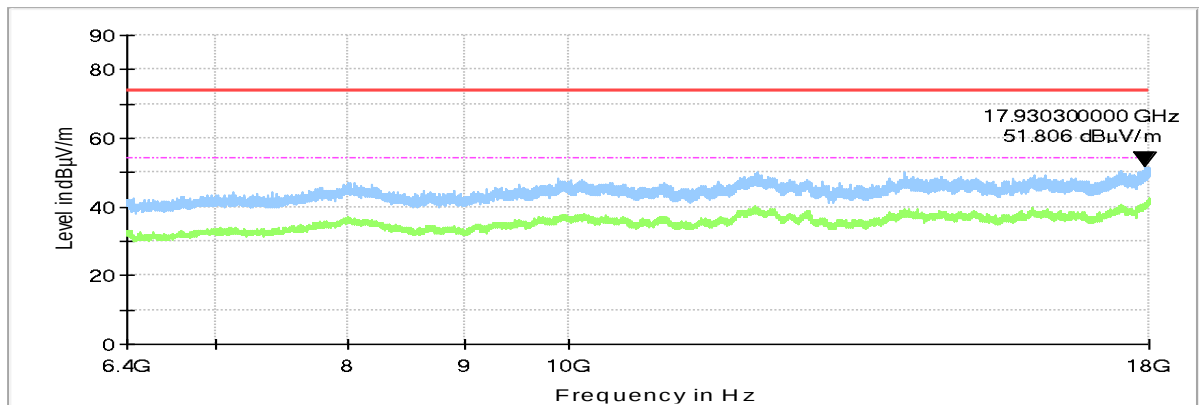
Test specification:		FCC section 15.407(b)4, RSS-247 section 6.2.4, Field strength of undesirable emissions	
Test procedure:		KDB 662911; KDB 789033, ANSI C63.10, section 12.7.6 & 12.7.7	
Test mode:		Verdict: PASS	
Date(s):			
07-Feb-19			
Temperature: 25 °C	Relative Humidity: 46 %	Air Pressure: 1012 hPa	Power: 48 VDC
Remarks:			

Plot 7.14.16 Radiated emission measurements from 6.4 to 18 GHz at the low carrier frequency

TEST SITE: Semi Anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical and Horizontal

**Plot 7.14.17 Radiated emission measurements from 6.4 to 18 GHz at the mid carrier frequency**

TEST SITE: Anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical and Horizontal

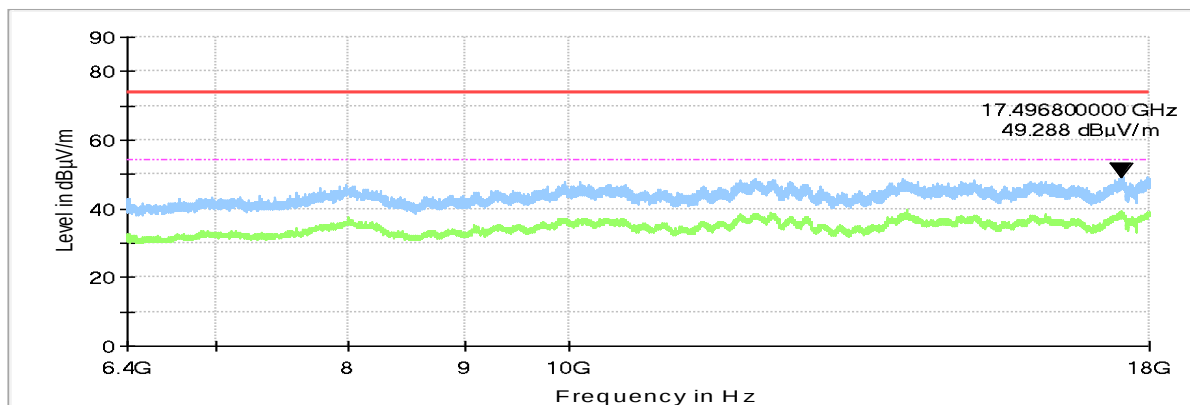




Test specification: FCC section 15.407(b)4, RSS-247 section 6.2.4, Field strength of undesirable emissions			
Test procedure: KDB 662911; KDB 789033, ANSI C63.10, section 12.7.6 & 12.7.7			
Test mode: Compliance		Verdict: PASS	
Date(s): 07-Feb-19			
Temperature: 25 °C	Relative Humidity: 46 %	Air Pressure: 1012 hPa	Power: 48 VDC
Remarks:			

Plot 7.14.18 Radiated emission measurements from 6.4 to 18 GHz at the high carrier frequency

TEST SITE: Anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical and Horizontal

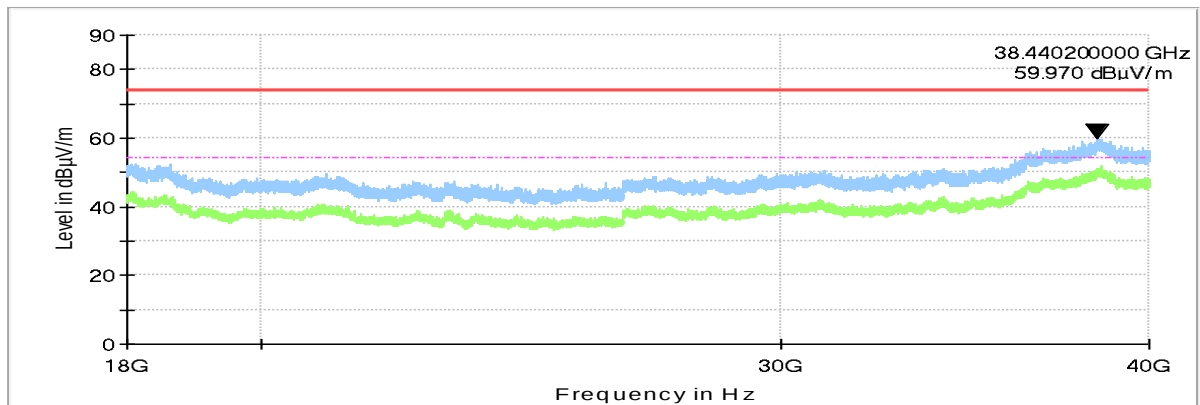




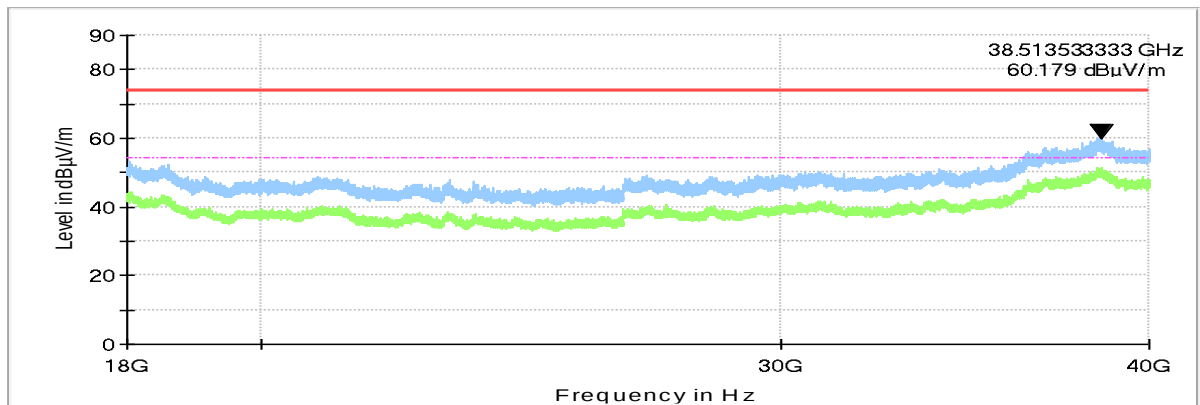
Test specification:		FCC section 15.407(b)4, RSS-247 section 6.2.4, Field strength of undesirable emissions	
Test procedure:		KDB 662911; KDB 789033, ANSI C63.10, section 12.7.6 & 12.7.7	
Test mode:		Verdict: PASS	
Date(s):			
07-Feb-19			
Temperature: 25 °C	Relative Humidity: 46 %	Air Pressure: 1012 hPa	Power: 48 VDC
Remarks:			

Plot 7.14.19 Radiated emission measurements from 18 to 40 GHz at the low carrier frequency

TEST SITE: Semi Anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical and Horizontal

**Plot 7.14.20 Radiated emission measurements from 18 to 40 GHz at the mid carrier frequency**

TEST SITE: Anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical and Horizontal

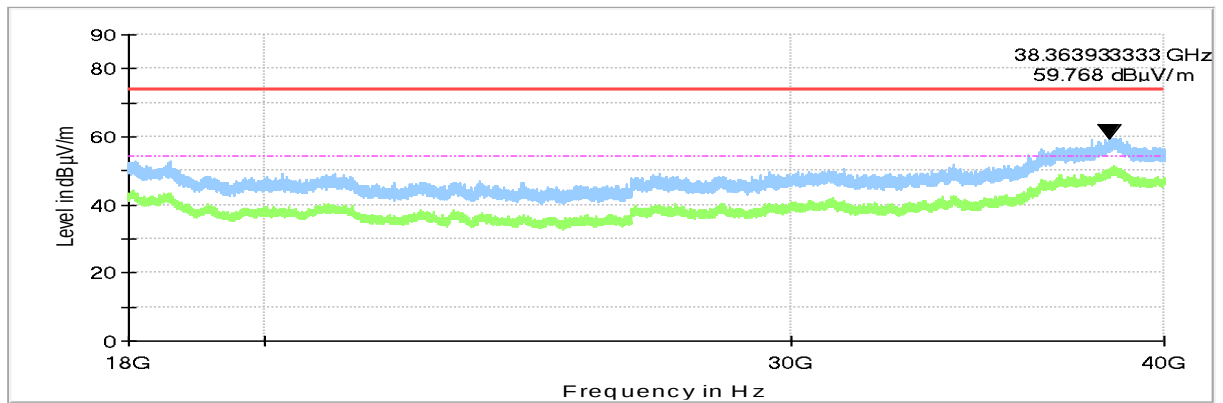




Test specification:		FCC section 15.407(b)4, RSS-247 section 6.2.4, Field strength of undesirable emissions	
Test procedure:		KDB 662911; KDB 789033, ANSI C63.10, section 12.7.6 & 12.7.7	
Test mode:		Verdict: PASS	
Date(s):			
07-Feb-19			
Temperature: 25 °C	Relative Humidity: 46 %	Air Pressure: 1012 hPa	Power: 48 VDC
Remarks:			

Plot 7.14.21 Radiated emission measurements from 18 to 40 GHz at the high carrier frequency

TEST SITE: Anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical and Horizontal



Test specification:		FCC section 15.407(b)(6), 15.207(a), RSS-Gen section 7.2, Conducted emissions	
Test procedure:		ANSI C63.10, Section 12.7.4.1, KDB 789033	
Test mode:		Verdict: PASS	
Date(s):			
Temperature: 26 °C	Relative Humidity: 48 %	Air Pressure: 1018 hPa	Power: 48 VDC
Remarks:			

7.15 Conducted emissions at 5150 – 5250 MHz range

General

This test was performed to measure common mode conducted emissions at the power port. Specification test limits are given in Table 7.15.1.

**Table 7.15.1 Limits for conducted emissions
according to FCC Part 15, Section 207 / RSS-Gen, Section 7.2**

Frequency, MHz	Class B limit, dB(μV)	
	QP	AVRG
0.15 - 0.5	66 - 56*	56 - 46*
0.5 - 5.0	56	46
5.0 - 30	60	50

* - The limit decreases linearly with the logarithm of frequency.

Test procedure

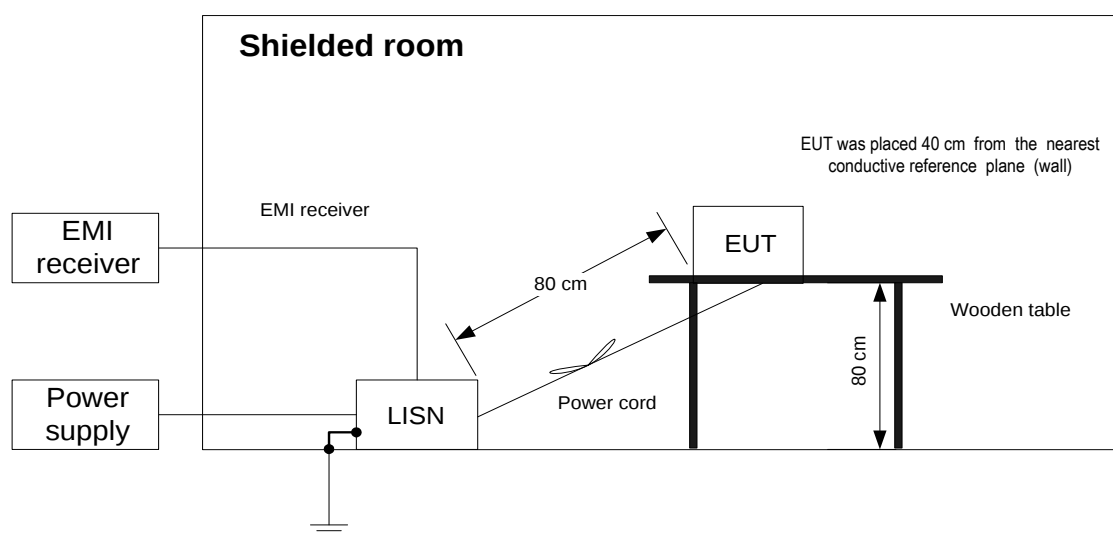
7.15.1.1 The EUT was set up as shown in Figure 7.15.1, energized and the performance check was conducted.

7.15.1.2 The measurements were performed at power terminals with the LISN, connected to a spectrum analyzer while unused coaxial connector of the LISN was terminated with 50 Ohm.

7.15.1.3 The position of the device cables was varied to determine maximum emission level.

7.15.1.4 The worst test results (the lowest margins) were recorded in Table 7.15.2 and shown in the associated plots.

Figure 7.15.1 Setup for conducted emission measurements, table-top equipment





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Report ID: TELRAD_FCC.31830

Date of Issue: 28-May-19

Test specification:		FCC section 15.407(b)(6), 15.207(a), RSS-Gen section 7.2, Conducted emissions	
Test procedure:		ANSI C63.10, Section 12.7.4.1, KDB 789033	
Test mode:		Verdict: PASS	
Date(s):			
21-Jan-19			
Temperature: 26 °C	Relative Humidity: 48 %	Air Pressure: 1018 hPa	Power: 48 VDC
Remarks:			

Table 7.15.2 Conducted emission test results according to FCC Part 15, Section 207 / RSS-Gen, Section 7.2

LINE: AC mains
 EUT OPERATING MODE: Transmit
 ASSIGNED FREQUENCY BAND: 5.15-5.25GHz
 OPERATING FREQUENCY: 5.2GHz
 EUT SET UP: TABLE-TOP
 TEST SITE: SHIELDED ROOM
 FREQUENCY RANGE: 150 kHz - 30 MHz
 RESOLUTION BANDWIDTH: 9 kHz

Frequency, MHz	Peak emission, dB(μV)	Quasi-peak			Average			Line ID	Verdict
		Measured emission, dB(μV)	Limit, dB(μV)	Margin, dB*	Measured emission, dB(μV)	Limit, dB(μV)	Margin, dB*		
0.150	60.1	54.6	66.0	-11.4	23.0	56.0	-33.0	L1	Pass
2.179	31.8	24.5	55.9	-31.4	10.1	45.9	-35.8		
5.137	42.0	37.6	60.0	-22.4	29.3	50.0	-20.7		
6.217	38.6	32.9	60.0	-27.1	24.4	50.0	-25.6		
12.727	37.3	31.4	60.0	-28.6	24.2	50.0	-25.8		
21.909	37.2	32.7	60.0	-27.3	28.9	50.0	-21.1		
0.151	60.3	54.7	66.0	-11.3	23.1	56.0	-32.9	L2	Pass
0.425	40.3	32.7	57.4	-24.7	4.1	47.4	-43.3		
5.148	44.9	38.9	60.0	-21.1	31.0	50.0	-19.0		
6.186	40.6	36.0	60.0	-24.0	26.6	50.0	-23.4		
12.619	42.6	35.0	60.0	-25.0	27.5	50.0	-22.5		
21.907	42.4	39.2	60.0	-20.8	36.0	50.0	-14.0		

*- Margin = Measured emission - specification limit.

Reference numbers of test equipment used

HI 0787	HL 1500	HL 2358	HL 2888	HL 4778			
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Full description is given in Appendix A.



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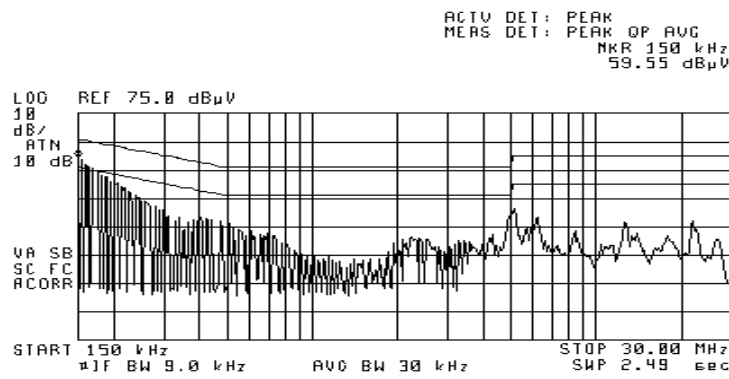
Report ID: TELRAD_FCC.31830

Date of Issue: 28-May-19

Test specification:		FCC section 15.407(b)(6), 15.207(a), RSS-Gen section 7.2, Conducted emissions	
Test procedure:		ANSI C63.10, Section 12.7.4.1, KDB 789033	
Test mode:		Compliance	Verdict: PASS
Date(s):		21-Jan-19	
Temperature: 26 °C	Relative Humidity: 48 %	Air Pressure: 1018 hPa	Power: 48 VDC
Remarks:			

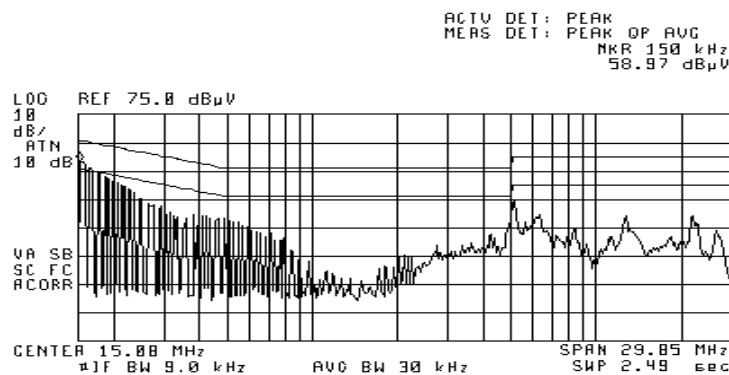
Plot 7.15.1 Conducted emission measurements

LINE: L1
EUT OPERATING MODE: Transmit
LIMIT: QUASI-PEAK, AVERAGE
DETECTOR: PEAK



Plot 7.15.2 Conducted emission measurements

LINE: L2
EUT OPERATING MODE: Transmit
LIMIT: QUASI-PEAK, AVERAGE
DETECTOR: PEAK





Test specification:		FCC section 15.407(b)(6), 15.207(a), RSS-Gen section 7.2, Conducted emissions	
Test procedure:		ANSI C63.10, Section 12.7.4.1, KDB 789033	
Test mode:		Verdict: PASS	
Date(s):			
21-Jan-19			
Temperature: 26 °C	Relative Humidity: 48 %	Air Pressure: 1018 hPa	Power: 48 VDC
Remarks:			

7.16 Conducted emissions at 5725 – 5850 MHz range

General

This test was performed to measure common mode conducted emissions at the power port. Specification test limits are given in Table 7.16.1

**Table 7.16.1 Limits for conducted emissions
according to FCC Part 15, Section 207 / RSS-Gen, Section 7.2**

Frequency, MHz	Class B limit, dB(μV)	
	QP	AVRG
0.15 - 0.5	66 - 56*	56 - 46*
0.5 - 5.0	56	46
5.0 - 30	60	50

* - The limit decreases linearly with the logarithm of frequency.

Test procedure

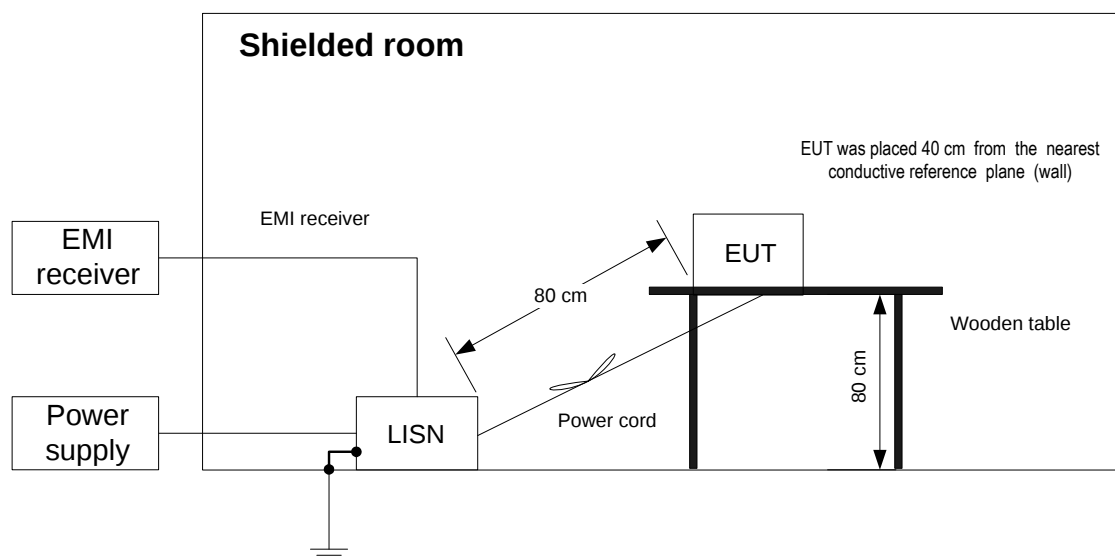
7.16.1.1 The EUT was set up as shown in Figure 7.16.1, energized and the performance check was conducted.

7.16.1.2 The measurements were performed at power terminals with the LISN, connected to a spectrum analyzer while unused coaxial connector of the LISN was terminated with 50 Ohm.

7.16.1.3 The position of the device cables was varied to determine maximum emission level.

7.16.1.4 The worst test results (the lowest margins) were recorded in Table 7.16.2 and shown in the associated plots.

Figure 7.16.1 Setup for conducted emission measurements, table-top equipment





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Report ID: TELRAD_FCC.31830
Date of Issue: 28-May-19

Test specification:		FCC section 15.407(b)(6), 15.207(a), RSS-Gen section 7.2, Conducted emissions	
Test procedure:		ANSI C63.10, Section 12.7.4.1, KDB 789033	
Test mode:		Verdict: PASS	
Date(s):			
21-Jan-19			
Temperature: 26 °C	Relative Humidity: 48 %	Air Pressure: 1018 hPa	Power: 48 VDC
Remarks:			

Table 7.16.2 Conducted emission test results according to FCC Part 15, Section 207 / RSS-Gen, Section 7.2

LINE: AC mains
EUT OPERATING MODE: Transmit
ASSIGNED FREQUENCY BAND: 5.725-5.850
OPERATING FREQUENCY: 5.800
EUT SET UP: TABLE-TOP
TEST SITE: SHIELDED ROOM
FREQUENCY RANGE: 150 kHz - 30 MHz
RESOLUTION BANDWIDTH: 9 kHz

Frequency, MHz	Peak emission, dB(μV)	Quasi-peak			Average			Line ID	Verdict
		Measured emission, dB(μV)	Limit, dB(μV)	Margin, dB*	Measured emission, dB(μV)	Limit, dB(μV)	Margin, dB*		
0.151	60.0	54.3	65.9	-11.6	22.7	55.9	-33.2	L1	
0.443	39.0	33.0	57.1	-24.1	4.1	47.1	-43.0		
4.312	35.9	29.1	56.0	-26.9	16.8	46.0	-29.2		
5.109	43.4	37.5	60.0	-22.5	28.8	50.0	-21.2		
6.239	38.6	32.0	60.0	-28.0	23.8	50.0	-26.2		
12.652	36.9	31.6	60.0	-28.4	24.1	50.0	-25.9		
0.151	60.5	54.9	65.9	-11.0	23.2	55.9	-32.7	L2	
0.418	40.5	34.2	57.5	-23.3	4.5	47.5	-43.0		
5.147	44.2	39.4	60.0	-20.6	31.4	50.0	-18.6		
6.262	43.6	36.8	60.0	-23.2	28.1	50.0	-21.9		
12.655	41.2	35.4	60.0	-24.6	27.8	50.0	-22.2		
22.457	42.7	38.8	60.0	-21.2	35.7	50.0	-14.3		

*- Margin = Measured emission - specification limit.

Reference numbers of test equipment used

HI 0787	HL 1500	HL 2358	HL 2888	HL 4778			
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Full description is given in Appendix A.



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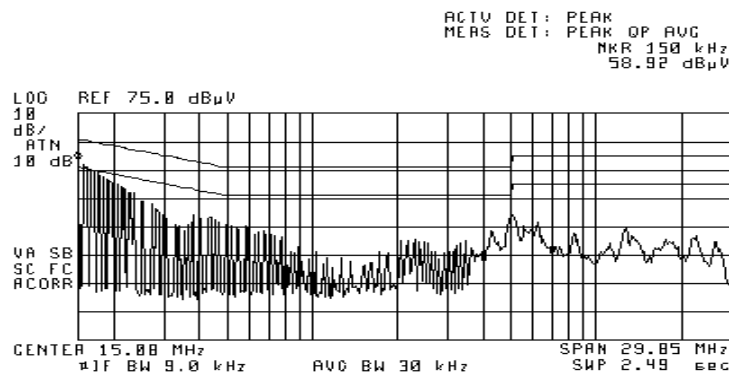
Report ID: TELRAD_FCC.31830

Date of Issue: 28-May-19

Test specification:		FCC section 15.407(b)(6), 15.207(a), RSS-Gen section 7.2, Conducted emissions	
Test procedure:		ANSI C63.10, Section 12.7.4.1, KDB 789033	
Test mode:		Verdict: PASS	
Date(s):			
21-Jan-19			
Temperature: 26 °C	Relative Humidity: 48 %	Air Pressure: 1018 hPa	Power: 48 VDC
Remarks:			

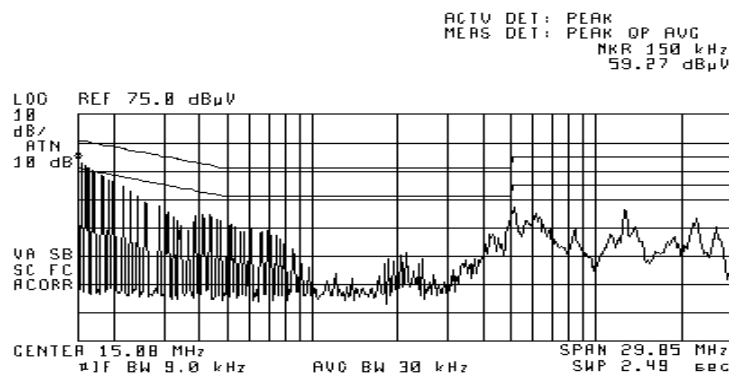
Plot 7.16.1 Conducted emission measurements

LINE: L1
EUT OPERATING MODE: Transmit
LIMIT: QUASI-PEAK, AVERAGE
DETECTOR: PEAK



Plot 7.16.2 Conducted emission measurements

LINE: L2
EUT OPERATING MODE: Transmit
LIMIT: QUASI-PEAK, AVERAGE
DETECTOR: PEAK





Test specification: FCC section 15.203, RSS-Gen section 6.8, Antenna requirement			
Test procedure: Visual inspection			
Test mode: Compliance		Verdict: PASS	
Date(s): 21-Jan-19			
Temperature: 26 °C	Relative Humidity: 49 %	Air Pressure: 1018 hPa	Power: 48 VDC
Remarks:			

7.17 Antenna requirements

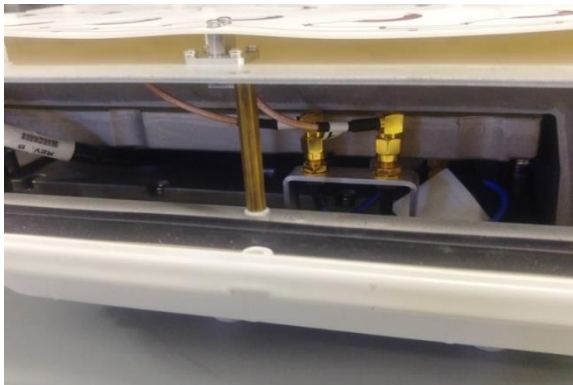
The EUT was verified for compliance with antenna requirements. A transmitter shall be designed to ensure that no antenna other than that furnished by the responsible party will be used with the device. It may be either permanently attached or employs a unique antenna connector for every antenna proposed for use with the EUT. This requirement does not apply to professionally installed transmitters.

The rationale for compliance with the above requirements was either visual inspection results or supplier declaration. The summary of results is provided in Table 7.17.1.

Table 7.17.1 Antenna requirements

Requirement	Rationale	Verdict
The transmitter antenna is permanently attached	Visual inspection	Comply
The transmitter employs a unique antenna connector	NA	
The transmitter requires professional installation	NA	

Photograph 7.17.1 Antenna assembly



8 APPENDIX A Test equipment and ancillaries used for tests

HL No	Description	Manufacturer	Model	Ser. No.	Last Cal./ Check	Due Cal./ Check
3901	Microwave Cable Assembly, 40.0 GHz, 3.5 m, SMA/SMA	Huber-Suhner	SUCOFL EX 102A	1225/2A	07-Apr-19	07-Apr-20
4068	Attenuator, SMA, 30 dB, DC to 12.4 GHz	Midwest Microwave	ATT-0527-30-SMA-07	NA	09-Aug-18	09-Aug-19
2909	Spectrum analyzer, ESA-E, 100 Hz to 26.5 GHz	Agilent Technologies	E4407B	MY41444762	04-Apr-19	04-Apr-20
3655	Ferrite Clamp	Luthi	FTC 101	4855	17-Jan-19	17-Jan-20
4355	Signal and Spectrum Analyzer, 9 kHz to 7 GHz	Rohde & Schwarz	FSV 7	101630	28-Jun-18	28-Jun-19
3301	Power Meter, P-series, 50 MHz to 40 GHz	Agilent Technologies	N1911A	MY45101057	02-May-18	02-May-19
3818	PSA Series Spectrum Analyzer, 3 Hz- 44 GHz	Agilent Technologies	E4446A	MY48250288	28-May-18	28-May-19
0446	Antenna, Loop, Active, 10 (9) kHz - 30 MHz	EMCO	6502	2857	24-Feb-19	24-Feb-20
0604	Antenna BiconiLog Log-Periodic/T Bow-TIE, 26 - 2000 MHz	EMCO	3141	9611-1011	03-Jun-18	03-Jun-19
3903	Microwave Cable Assembly, 40.0 GHz, 1.5 m, SMA/SMA	Huber-Suhner	SUCOFL EX 102A	1226/2A	07-Apr-19	07-Apr-20
4360	EMI Test Receiver, 20 Hz to 40 GHz.	Rohde & Schwarz	ESU40	100322	31-Dec-18	31-Dec-19
4933	Active Horn Antenna, 1 GHz to 18 GHz	COM-POWER CORPORATION	AHA-118	701046	06-Jan-19	06-Jan-20
4956	Active horn antenna, 18 to 40 GHz	COM-POWER CORPORATION	AHA-840	105004	25-Jan-19	25-Jan-20
5405	RF cable, 18 GHz, N-N, 6 m	Huber-Suhner	SF118/11 N(x2)	500023/118	01-Aug-18	01-Aug-19
1500	Cable RF, 15 m, N/N-type	Suhner Switzerland	RG 214/U	1500	11-Feb-19	11-Feb-20
2358	Power Supply, 2 X 0-36VDC / 5A, 5VDC / 5A	Horizon Electronics	DHR3655D	767469	03-Jun-18	03-Jun-19
2888	LISN Two-line V-Network 50 Ohm / 50 uH + 5 Ohm, 16A, MIL STD 461E, CISPR 16-1	Rolf Heine	NNB-2/16Z	02/10018	19-Mar-19	19-Mar-20
4778	EMI Receiver, 9 kHz - 2.9 GHz, System: HL1431, HL4777	Hewlett Packard	8542E	30807A00262, 3427A00123	28-Oct-18	28-Oct-19

9 APPENDIX B Measurement uncertainties

Expanded uncertainty at 95% confidence in Hermon Labs EMC measurements

Test description	Expanded uncertainty
Conducted emissions with LISN	9 kHz to 150 kHz: ± 3.9 dB 150 kHz to 30 MHz: ± 3.8 dB
Radiated emissions at 10 m measuring distance Horizontal polarization Vertical polarization	Biconilog antenna: ± 5.0 dB Biconical antenna: ± 5.0 dB Log periodic antenna: ± 5.1 dB Double ridged horn antenna: ± 5.3 dB Biconilog antenna: ± 5.5 dB Biconical antenna: ± 5.5 dB Log periodic antenna: ± 5.6 dB Double ridged horn antenna: ± 5.8 dB
Radiated emissions at 3 m measuring distance Horizontal polarization Vertical polarization	Biconilog antenna: ± 5.3 dB Biconical antenna: ± 5.0 dB Log periodic antenna: ± 5.3 dB Double ridged horn antenna: ± 5.3 dB Biconilog antenna: ± 6.0 dB Biconical antenna: ± 5.7 dB Log periodic antenna: ± 6.0 dB Double ridged horn antenna: ± 6.0 dB
Conducted emissions at RF antenna connector	9 kHz to 2.9 GHz: ± 2.6 dB 2.9 GHz to 6.46 GHz: ± 3.5 dB 6.46 GHz to 13.2 GHz: ± 4.3 dB 13.2 GHz to 22.0 GHz: ± 5.0 dB 22.0 GHz to 26.8 GHz: ± 5.5 dB 26.8 GHz to 40.0 GHz: ± 4.8 dB
Duty cycle, timing (Tx ON / OFF) and average factor measurements	± 1.0 %
Occupied bandwidth	± 8.0 %

Hermon Laboratories is accredited by A2LA for calibration according to present requirements of ISO/IEC 17025 and NCSL Z540-1. The accreditation is granted to perform calibration of parameters that are listed in the Scope of Hermon Laboratories Accreditation.

Hermon Laboratories calibrates its reference and transfer standards by calibration laboratories accredited to ISO/IEC 17025 by a mutually recognized Accreditation Body or by a recognized national metrology institute. All reference and transfer standards used in the calibration system are traceable to national or international standards.

In-house calibration of all test and measurement equipment is performed on a regular basis according to Hermon Laboratories calibration procedures, manufacturer calibration/verification procedures or procedures defined in the relevant standards. The Hermon Laboratories test and measurement equipment is calibrated within the tolerances specified by the manufacturers and/or by the relevant standards.

10 APPENDIX C Test laboratory description

Tests were performed at Hermon Laboratories Ltd., which is a fully independent, private, EMC, Radio, Safety, Environmental and Telecommunication testing facility.

Hermon Laboratories is recognized and accredited by the Federal Communications Commission (USA) for relevant parts of Code of Federal Regulations 47 (CFR 47), Test Firm Registration Number is 927748, Designation Number is IL1001; Recognized by Innovation, Science and Economic Development Canada for wireless and terminal testing (ISED), ISED #2186A, CAB identifier is IL1001; Certified by VCCI, Japan (the registration numbers are R-10808 for OATS, R-1082 for anechoic chamber, G-10869 for RE measurements above 1 GHz, C-10845 for conducted emissions site and T-11606 for conducted emissions at telecommunication ports).

The laboratory is accredited by American Association for Laboratory Accreditation (USA) according to ISO/IEC 17025 for electromagnetic compatibility, product safety, telecommunications testing, environmental simulation and calibration (for exact scope please refer to Certificate No. 839.01, 839.03 and 839.04).

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11 APPENDIX D Specification references

FCC 47CFR part 15:2017	Radio Frequency Devices.
ANSI C63.10:2013	American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices
RSS-247:2017, Issue 2	Digital Transmission Systems (DTSS), Frequency Hopping Systems (FHSs) and License Exempt Local Area Network (LE-LAN) Devices
RSS-Gen:2018, Issue 5	General Requirements for Compliance of Radio Apparatus
KDB 662911:2013	Guidance for Emissions Testing of Transmitters with Multiple Outputs in the Same Band under section 15.407 of the FCC rules
KDB 789033:2017	Guidance for compliance testing of unlicensed national information infrastructure (U-NII) devices Part 15, Subpart E

12 APPENDIX E Test equipment correction factors

HL 0446: Active Loop Antenna
EMCO, model: 6502, s/n 2857

Frequency,	Measured antenna factor, dBS/m	Measurement uncertainty, dB
10	-33.4	±1.0
20	-37.8	±1.0
50	-40.5	±1.0
75	-41.0	±1.0
100	-41.2	±1.0
150	-41.2	±1.0
250	-41.1	±1.0
500	-41.2	±1.0
750	-41.3	±1.0
1000	-41.3	±1.0

Frequency,	Measured antenna factor, dBS/m	Measurement uncertainty, dB
2000	-41.4	±1.0
3000	-41.4	±1.0
4000	-41.5	±1.0
5000	-41.5	±1.0
10000	-41.7	±1.0
15000	-42.1	±1.0
20000	-42.7	±1.0
25000	-44.2	±1.0
30000	-45.8	±1.0

The antenna factor shall be added to receiver reading in dB μ V to obtain field strength in dB μ A/m.

HL 0604: Antenna BiconiLog Log-Periodic/T Bow-TIE
EMCO, model 3141, serial number 9611-1011

Frequency, MHz	Antenna factor, dB/m		
	Measured	Last	Deviation
30	12.1	12.6	-0.5
35	9.1	9.5	-0.4
40	8.0	8.3	-0.3
45	8.3	8.6	-0.3
50	9.0	9.1	-0.1
60	10.5	10.7	-0.2
70	11.4	11.3	0.1
80	12.3	12.2	0.1
90	13.4	13.2	0.2
100	13.0	13.0	0.0
120	11.4	11.4	0.0
140	12.5	12.4	0.1
160	14.9	14.8	0.1
180	14.4	14.0	0.4
200	13.7	13.9	-0.2
250	16.3	16.4	-0.1
300	17.2	17.5	-0.3
400	19.8	20.2	-0.4
500	22.0	22.4	-0.4
600	24.3	24.5	-0.2
700	25.8	25.6	0.2
800	26.9	26.6	0.3
900	27.3	28.0	-0.7
1000	28.5	29.3	-0.8

The antenna factor shall be added to receiver reading in dB μ V to obtain field strength in dB μ V/m.

HL 4933: Active Horn Antenna
COM-POWER CORPORATION, model: AHA-118, s/n 701046

Frequency, MHz	Measured antenna factor (with preamplifier), dB/m
1000	-16.1
1500	-15.1
2000	-10.9
2500	-11.9
3000	-11.1
3500	-10.6
4000	-8.6
4500	-8.3
5000	-5.9
5500	-5.7
6000	-3.3
6500	-4.0
7000	-2.2
7500	-1.7
8000	1.1
8500	-0.8
9000	-1.5
9500	-0.2

Frequency, MHz	Measured antenna factor (with preamplifier), dB/m
10000	1.8
10500	1.0
11000	0.3
11500	-0.5
12000	3.1
12500	1.4
13000	-0.3
13500	-0.4
14000	2.5
14500	2.2
15000	1.9
15500	0.5
16000	2.1
16500	1.2
17000	0.6
17500	3.1
18000	4.2

The antenna factor shall be added to receiver reading in dB μ V to obtain field strength in dB μ V/m.

HL 4956: Active horn antenna
COM-POWER Corp., model: AHA-840, s/n 105004

Frequency, MHz	Measured antenna factor, dB/m
18000	5.1
18500	3.6
19000	2.2
19500	0.7
20000	0.7
20500	0.8
21000	0.5
21500	-1.3
22000	-2.1
22500	-2.0
23000	-1.6
23500	-2.9
24000	-2.3
24500	-2.6
25000	-1.8
25500	-1.2
26000	-0.5
26500	-1.2
27000	-0.1
27500	-1.0
28000	-0.7
28500	0.5

Frequency, MHz	Measured antenna factor, dB/m
29500	1.4
30000	2.9
30500	2.9
31000	2.9
31500	1.2
32000	0.7
32500	0.2
33000	-1.7
33500	-2.2
34000	2.3
34500	-1.1
35000	0.7
35500	-1.1
36000	0.1
36500	1.4
37000	3.7
37500	5.8
38000	6.6
38500	7.3
39000	6.5
39500	7.3
40000	7.1

The antenna factor shall be added to receiver reading in dB μ V to obtain field strength in dB μ V/m.

HL 1500: Cable , 15 m, N/N-type,
Suhner Switzerland RG214/U, s/n 1500 HL 1500

Insertion loss

Set / Applied, MHz	Measured, dB	Uncertainty, dB
10	0.30	±0.07
50	0.71	±0.07
100	1.03	±0.07
150	1.28	±0.07
200	1.51	±0.07
250	1.71	±0.07
300	1.89	±0.07
350	2.06	±0.08
400	2.23	±0.08
450	2.38	±0.08
500	2.54	±0.08
550	2.68	±0.08
600	2.83	±0.08
650	2.96	±0.08
700	3.10	±0.08
750	3.23	±0.08
800	3.36	±0.08
850	3.49	±0.08
900	3.61	±0.08
950	3.74	±0.08
1000	3.86	±0.08
1050	3.98	±0.12
1100	4.10	±0.12
1150	4.22	±0.12
1200	4.35	±0.12
1250	4.46	±0.12
1300	4.58	±0.12

Set / Applied, MHz	Measured, dB	Uncertainty, dB
1350	4.71	±0.12
1400	4.82	±0.12
1450	4.95	±0.12
1500	5.06	±0.12
1550	5.18	±0.12
1600	5.30	±0.12
1650	5.42	±0.12
1700	5.53	±0.12
1750	5.64	±0.12
1800	5.77	±0.12
1850	5.87	±0.12
1900	6.00	±0.12
1950	6.12	±0.12
2000	6.23	±0.12

HL 3901: Microwave Cable Assembly, 40.0 GHz, 3.5 m, SMA/SMA
Huber-Suhner, model: SUCOFLEX 102A, s/n: 1225/2A

HL 3901: Insertion loss

Set / Applied, MHz	Measured, dB	Uncertainty, dB
50	0.34	±0.06
100	0.47	±0.06
150	0.58	±0.07
200	0.67	±0.07
300	0.82	±0.07
400	0.94	±0.07
500	1.05	±0.07
600	1.15	±0.07
700	1.24	±0.07
800	1.33	±0.07
900	1.41	±0.07
1000	1.49	±0.07
1100	1.56	±0.07
1200	1.62	±0.07
1300	1.69	±0.07
1400	1.76	±0.07
1500	1.82	±0.07
1600	1.88	±0.07
1700	1.94	±0.07
1800	2.00	±0.07
1900	2.05	±0.07
2000	2.11	±0.07
2100	2.16	±0.07
2200	2.21	±0.07
2300	2.26	±0.07
2400	2.32	±0.07
2500	2.36	±0.09
2600	2.42	±0.09
2700	2.47	±0.09
2800	2.52	±0.09
2800	2.52	±0.09
2900	2.57	±0.09
3000	2.62	±0.09
3100	2.67	±0.09
3200	2.72	±0.09
3300	2.76	±0.09
3400	2.80	±0.09
3500	2.84	±0.09
3600	2.88	±0.09
3700	2.93	±0.09
3800	2.96	±0.09
3900	3.00	±0.09
4000	3.04	±0.09
4100	3.08	±0.13
4200	3.11	±0.13
4300	3.15	±0.13
4400	3.19	±0.13
4500	3.22	±0.13
4600	3.26	±0.13

Set / Applied, MHz	Measured, dB	Uncertainty, dB
4700	3.29	±0.13
4800	3.33	±0.13
4900	3.36	±0.13
5000	3.40	±0.13
5100	3.43	±0.13
5200	3.46	±0.13
5300	3.50	±0.13
5400	3.53	±0.13
5500	3.56	±0.13
5600	3.59	±0.13
5700	3.62	±0.13
5800	3.65	±0.13
5900	3.68	±0.13
6000	3.71	±0.13
6100	3.74	±0.13
6200	3.78	±0.13
6300	3.81	±0.13
6400	3.84	±0.13
6500	3.88	±0.13
6600	3.91	±0.13
6700	3.95	±0.13
6800	3.99	±0.13
6900	4.02	±0.13
7000	4.05	±0.13
7100	4.09	±0.13
7200	4.12	±0.13
7300	4.16	±0.13
7400	4.19	±0.13
7500	4.23	±0.13
7600	4.26	±0.13
7700	4.30	±0.13
7800	4.33	±0.13
7900	4.36	±0.13
8000	4.39	±0.13
8100	4.42	±0.13
8200	4.45	±0.13
8300	4.48	±0.13
8400	4.50	±0.13
8500	4.53	±0.13
8600	4.56	±0.13
8700	4.58	±0.13
8800	4.61	±0.13
8900	4.63	±0.13
9000	4.66	±0.13
9100	4.67	±0.13
9200	4.69	±0.13
9300	4.72	±0.13
9400	4.75	±0.13
9500	4.77	±0.13

HL 3901: Insertion loss

Set / Applied, MHz	Measured, dB	Uncertainty, dB
9600	4.79	±0.13
9700	4.81	±0.13
9800	4.84	±0.13
9900	4.87	±0.13
10000	4.89	±0.13
10100	4.92	±0.13
10200	4.94	±0.13
10300	4.96	±0.13
10400	4.98	±0.13
10500	5.01	±0.13
10600	5.02	±0.13
10700	5.05	±0.13
10800	5.07	±0.13
10900	5.10	±0.13
11000	5.12	±0.13
11100	5.15	±0.13
11200	5.18	±0.13
11300	5.21	±0.13
11400	5.23	±0.13
11500	5.26	±0.13
11600	5.30	±0.13
11700	5.33	±0.13
11800	5.36	±0.13
11900	5.39	±0.13
12000	5.42	±0.13
12100	5.45	±0.16
12200	5.48	±0.16
12300	5.52	±0.16
12400	5.56	±0.16
12500	5.59	±0.22
12600	5.61	±0.22
12700	5.65	±0.22
12800	5.69	±0.22
12900	5.72	±0.22
13000	5.74	±0.22
13100	5.78	±0.22
13200	5.80	±0.22
13300	5.83	±0.22
13400	5.85	±0.22
13500	5.87	±0.22
13600	5.89	±0.22
13700	5.91	±0.22
13800	5.94	±0.22
13900	5.95	±0.22
14000	5.97	±0.22
14100	5.99	±0.22
14200	6.02	±0.22
14300	6.02	±0.22
14400	6.04	±0.22
14500	6.06	±0.22

Set / Applied, MHz	Measured, dB	Uncertainty, dB
14600	6.08	±0.22
14700	6.09	±0.22
14800	6.12	±0.22
14900	6.14	±0.22
15000	6.15	±0.22
15100	6.18	±0.22
15200	6.21	±0.22
15300	6.23	±0.22
15400	6.25	±0.22
15500	6.28	±0.22
15600	6.31	±0.22
15700	6.33	±0.22
15800	6.36	±0.22
15900	6.39	±0.22
16000	6.40	±0.22
16100	6.43	±0.22
16200	6.47	±0.22
16300	6.50	±0.22
16400	6.52	±0.22
16500	6.55	±0.22
16600	6.58	±0.22
16700	6.62	±0.22
16800	6.63	±0.22
16900	6.67	±0.22
17000	6.69	±0.22
17100	6.72	±0.22
17200	6.74	±0.22
17300	6.74	±0.22
17400	6.76	±0.22
17500	6.79	±0.22
17600	6.82	±0.22
17700	6.80	±0.22
17800	6.81	±0.22
17900	6.82	±0.22
17200	6.74	±0.22
17300	6.74	±0.22
17400	6.76	±0.22
17500	6.79	±0.22
17600	6.82	±0.22
17700	6.80	±0.22
17800	6.81	±0.22
17900	6.82	±0.22
18000	6.85	±0.22
18500	6.95	±0.42
19000	7.08	±0.42
19500	7.15	±0.42
20000	7.19	±0.42
20500	7.24	±0.42
21000	7.32	±0.42
21500	7.42	±0.42



HL 3901: Insertion loss

Set / Applied, MHz	Measured, dB	Uncertainty, dB
22000	7.57	±0.42
22500	7.70	±0.42
23000	7.81	±0.42
23500	7.85	±0.42
24000	7.86	±0.42
24500	7.94	±0.42
25000	8.02	±0.42
25500	8.12	±0.42
26000	8.23	±0.42
26500	8.33	±0.42
27000	8.39	±0.57
27500	8.42	±0.57
28000	8.43	±0.57
28500	8.48	±0.57
29000	8.57	±0.57
29500	8.65	±0.57
30000	8.70	±0.57
30500	8.77	±0.57

Set / Applied, MHz	Measured, dB	Uncertainty, dB
31000	8.84	±0.57
31500	8.93	±0.57
32000	9.07	±0.57
33500	9.25	±0.57
34000	9.32	±0.57
34500	9.39	±0.57
35000	9.49	±0.57
35500	9.59	±0.57
36000	9.68	±0.57
36500	9.76	±0.57
37000	9.85	±0.57
37500	9.98	±0.57
38000	10.07	±0.57
38500	10.12	±0.57
39000	10.19	±0.57
39500	10.29	±0.57
40000	10.36	±0.57

HL 3903: Microwave Cable Assembly, 40.0 GHz, 1.5 m, SMA/SMA
Huber-Suhner SUCOFLEX 102A, s/n: 1226/2A

Set / Applied, MHz	Measured, dB	Uncertainty, dB	Set / Applied, MHz	Measured, dB	Uncertainty, dB
50	0.14	±0.06	4400	1.31	±0.13
100	0.19	±0.06	4500	1.33	±0.13
150	0.24	±0.07	4600	1.34	±0.13
200	0.28	±0.07	4700	1.36	±0.13
300	0.34	±0.07	4800	1.37	±0.13
400	0.39	±0.07	4900	1.39	±0.13
500	0.44	±0.07	5000	1.40	±0.13
600	0.49	±0.07	5100	1.41	±0.13
700	0.52	±0.07	5200	1.43	±0.13
800	0.56	±0.07	5300	1.45	±0.13
900	0.59	±0.07	5400	1.46	±0.13
1000	0.62	±0.07	5500	1.47	±0.13
1100	0.65	±0.07	5600	1.48	±0.13
1200	0.68	±0.07	5700	1.50	±0.13
1300	0.71	±0.07	5800	1.51	±0.13
1400	0.74	±0.07	5900	1.52	±0.13
1500	0.76	±0.07	6000	1.54	±0.13
1600	0.78	±0.07	6100	1.55	±0.13
1700	0.81	±0.07	6200	1.56	±0.13
1800	0.83	±0.07	6300	1.58	±0.13
1900	0.86	±0.07	6400	1.59	±0.13
2000	0.88	±0.07	6500	1.60	±0.13
2100	0.90	±0.07	6600	1.61	±0.13
2200	0.92	±0.07	6700	1.63	±0.13
2300	0.94	±0.07	6800	1.64	±0.13
2400	0.96	±0.07	6900	1.65	±0.13
2500	0.98	±0.09	7000	1.66	±0.13
2600	1.00	±0.09	7100	1.68	±0.13
2700	1.02	±0.09	7200	1.69	±0.13
2800	1.04	±0.09	7300	1.70	±0.13
2900	1.06	±0.09	7400	1.71	±0.13
3000	1.08	±0.09	7500	1.73	±0.13
3100	1.10	±0.09	7600	1.74	±0.13
3200	1.11	±0.09	7700	1.76	±0.13
3300	1.14	±0.09	7800	1.76	±0.13
3400	1.15	±0.09	7900	1.78	±0.13
3500	1.17	±0.09	8000	1.78	±0.13
3600	1.19	±0.09	8100	1.80	±0.13
3700	1.20	±0.09	8200	1.81	±0.13
3800	1.21	±0.09	8300	1.82	±0.13
3900	1.23	±0.09	8400	1.82	±0.13
4000	1.25	±0.09	8500	1.85	±0.13
4100	1.27	±0.13	8600	1.86	±0.13
4200	1.28	±0.13	8700	1.87	±0.13
4300	1.30	±0.13			

Set / Applied, MHz	Measured, dB	Uncertainty, dB
8800	1.87	±0.13
8900	1.89	±0.13
9000	1.90	±0.13
9100	1.91	±0.13
9200	1.92	±0.13
9300	1.93	±0.13
9400	1.95	±0.13
9500	1.95	±0.13
9600	1.97	±0.13
9700	1.98	±0.13
9800	1.99	±0.13
9900	2.00	±0.13
10000	2.01	±0.13
10100	2.02	±0.13
10200	2.02	±0.13
10300	2.04	±0.13
10400	2.05	±0.13
10500	2.06	±0.13
10600	2.07	±0.13
10700	2.08	±0.13
10800	2.09	±0.13
10900	2.10	±0.13
11000	2.11	±0.13
11100	2.12	±0.13
11200	2.13	±0.13
11300	2.14	±0.13
11400	2.15	±0.13
11500	2.15	±0.13
11600	2.17	±0.13
11700	2.17	±0.13
11800	2.19	±0.13
11900	2.19	±0.13
12000	2.20	±0.13
12100	2.21	±0.16
12200	2.22	±0.16
12300	2.23	±0.16
12400	2.25	±0.16
12500	2.26	±0.22
12600	2.26	±0.22
12700	2.27	±0.22
12800	2.29	±0.22
12900	2.30	±0.22
13000	2.30	±0.22
13100	2.31	±0.22
13200	2.32	±0.22
13400	2.34	±0.22

Set / Applied, MHz	Measured, dB	Uncertainty, dB
13500	2.35	±0.22
13600	2.36	±0.22
13700	2.36	±0.22
13800	2.38	±0.22
13900	2.38	±0.22
14000	2.40	±0.22
14100	2.40	±0.22
14200	2.41	±0.22
14300	2.42	±0.22
14400	2.43	±0.22
14500	2.44	±0.22
14600	2.45	±0.22
14700	2.46	±0.22
14800	2.47	±0.22
14900	2.48	±0.22
15000	2.49	±0.22
15100	2.49	±0.22
15200	2.51	±0.22
15300	2.51	±0.22
15400	2.52	±0.22
15500	2.53	±0.22
15600	2.54	±0.22
15700	2.54	±0.22
15800	2.55	±0.22
15900	2.56	±0.22
16000	2.57	±0.22
16100	2.58	±0.22
16200	2.59	±0.22
16300	2.60	±0.22
16400	2.61	±0.22
16500	2.62	±0.22
16600	2.63	±0.22
16700	2.63	±0.22
16800	2.63	±0.22
16900	2.65	±0.22
17000	2.66	±0.22
17100	2.66	±0.22
17200	2.67	±0.22
17300	2.68	±0.22
17400	2.69	±0.22
17500	2.70	±0.22
17600	2.71	±0.22
17700	2.71	±0.22
17800	2.72	±0.22
17900	2.74	±0.22

13 APPENDIX F Abbreviations and acronyms

A	ampere
AC	alternating current
AM	amplitude modulation
AVRG	average (detector)
cm	centimeter
dB	decibel
dBm	decibel referred to one milliwatt
dB(μ V)	decibel referred to one microvolt
dB(μ V/m)	decibel referred to one microvolt per meter
dB(μ A)	decibel referred to one microampere
DC	direct current
EIRP	equivalent isotropically radiated power
ERP	effective radiated power
EUT	equipment under test
F	frequency
GHz	gigahertz
GND	ground
H	height
HL	Hermon laboratories
Hz	hertz
k	kilo
kHz	kilohertz
LO	local oscillator
m	meter
MHz	megahertz
min	minute
mm	millimeter
ms	millisecond
μ s	microsecond
NA	not applicable
NB	narrow band
OATS	open area test site
Ω	Ohm
PM	pulse modulation
PS	power supply
ppm	part per million (10^{-6})
QP	quasi-peak
RE	radiated emission
RF	radio frequency
rms	root mean square
Rx	receive
s	second
T	temperature
Tx	transmit
V	volt

END OF DOCUMENT